United States Air Force
Scientific Advisory Board

Building the Joint Battlespace Infosphere

1999 Study

Overview

- Our Team and Our Charter
- The JBI in Operation
- JBI Technical Description
- Acquiring the JBI
- Evolving the JBI
- Information Management in the JBI
- Actionable Recommendations

Our Team

Chair: **General (Ret) Jim McCarthy**

GO Participant: MG Jerry Perryman

Joint
Vice Adm (Ret) David Frost
Lt Gen (Ret) Carl Franklin
Mr Ed Mahen

Commercial
Prof Randy Katz
Mr Sean Rice
Mr Troy Crites
Mr Carl Kessler
Dr Steve Wolff

Manipulate
Dr Bob Sproull
Dr Barry Leiner
Dr Bill Rouse
Mr Skip Saunders
Dr Scott Renner
Dr. Nort Fowler

Input
Dr Chuck Morefield
Prof Ed Feigenbaum
Prof Jim Hendler
Maj Gen (Ret) Rich O'Lear
Dr Bob Miller

Interact
Dr Valerie Gawron
Dr Duane Adams
Dr Doc Dougherty
Dr Bob Eggleston
Mr Scott Fouse

Govt Advisors
BG Ben Robinson
Dr Kevin Kreitman
Mr Brian Sharkey
Mr James Shaw
Maj Steve Jenkins

Support
Maj Jason Moore
Maj Laura Olsen
Capt Dave Gaines
Capt Brent Morris
Capt Matt Yocum

Our Charter

- Assess commercial IT research so that advances may be quickly applied to the spiral development of combat information management systems.
- Identify approaches for creating combat information management systems and for developing rule-based information distribution processes.
- Identify interoperability issues for joint and coalition information requirements.
- Investigate and document where DoD resources need to be applied to support the military unique requirements in combat information management.
- Develop an implementation plan.

Study Assumptions

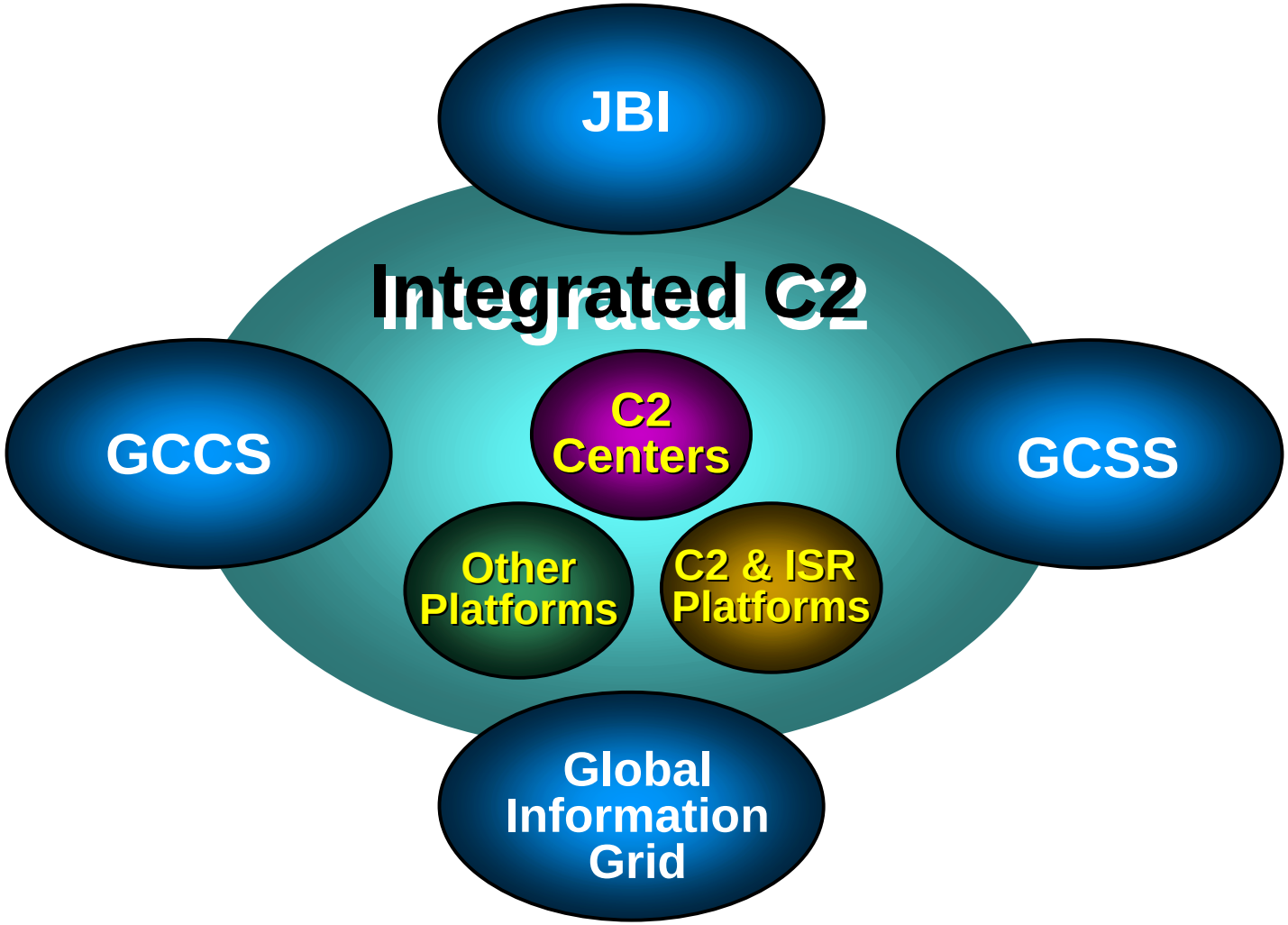
- Current commercial developments and DoD technology deployments will yield sufficient bandwidth, connectivity, computation, storage
- JBI information assurance/protection assume broader DoD efforts, but also include study-generated recommendations for JBI protection & adjustment to degradation of information management capability

JBI Basics

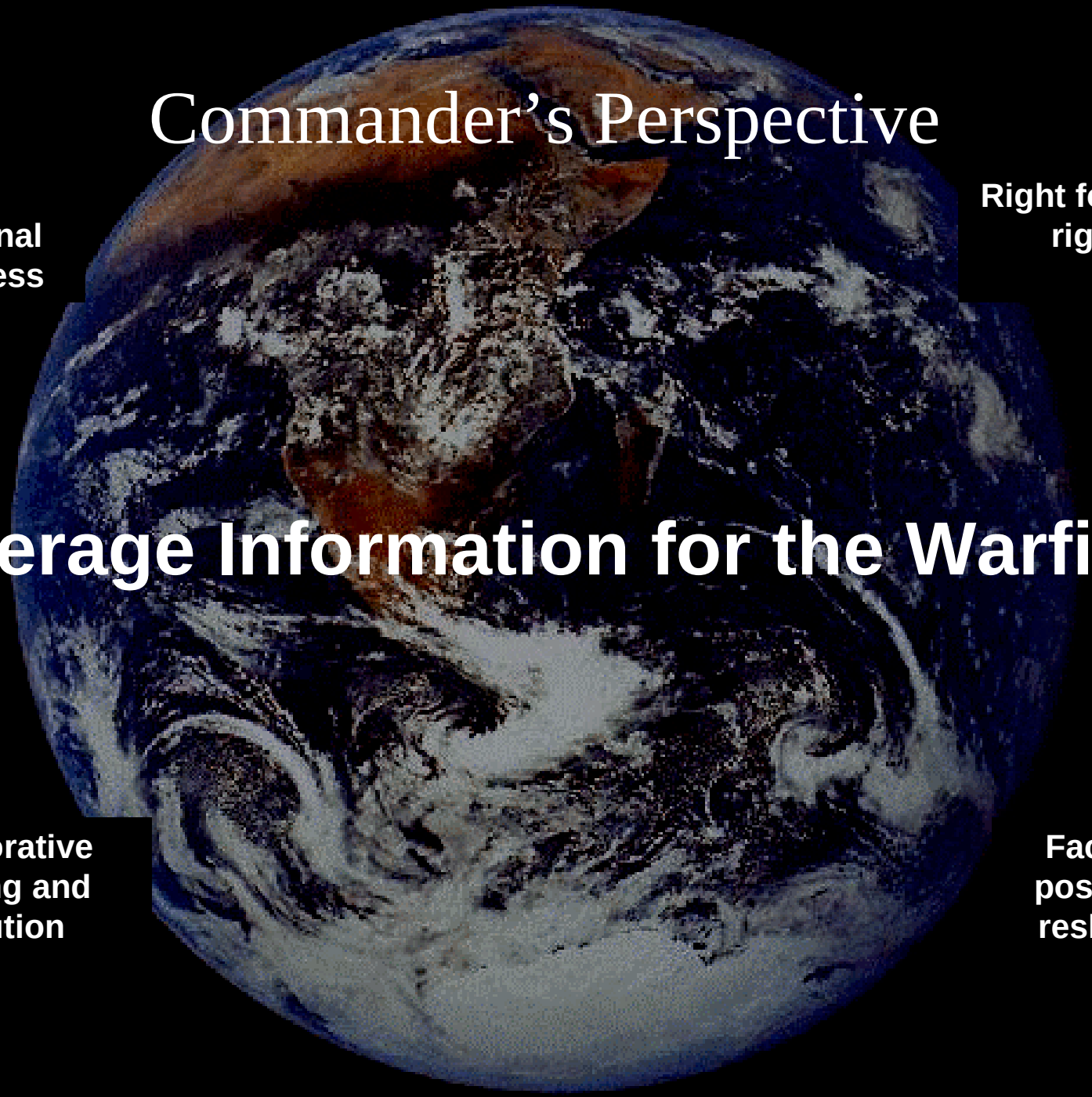
The JBI is a system of systems that integrates, aggregates, and distributes information to users at all echelons, from the command center to the battlefield. The JBI is built on four key technologies:

- Information exchange
  - Publish/Subscribe
- Transforming data to knowledge
  - Fuselets
- Distributed collaboration
  - Shared, updatable knowledge objects
- Force/Unit interfaces
  - Templates
    - Operational capability
    - Information inputs
    - Information requirements

The Vision


JBI
Integrated C2
GCCS
C2 Centers
GCSS
Other Platforms
C2 & ISR Platforms
Global Information Grid

Commander's Perspective



Total situational awareness

Right forces at the right time

Leverage Information for the Warfighter

!

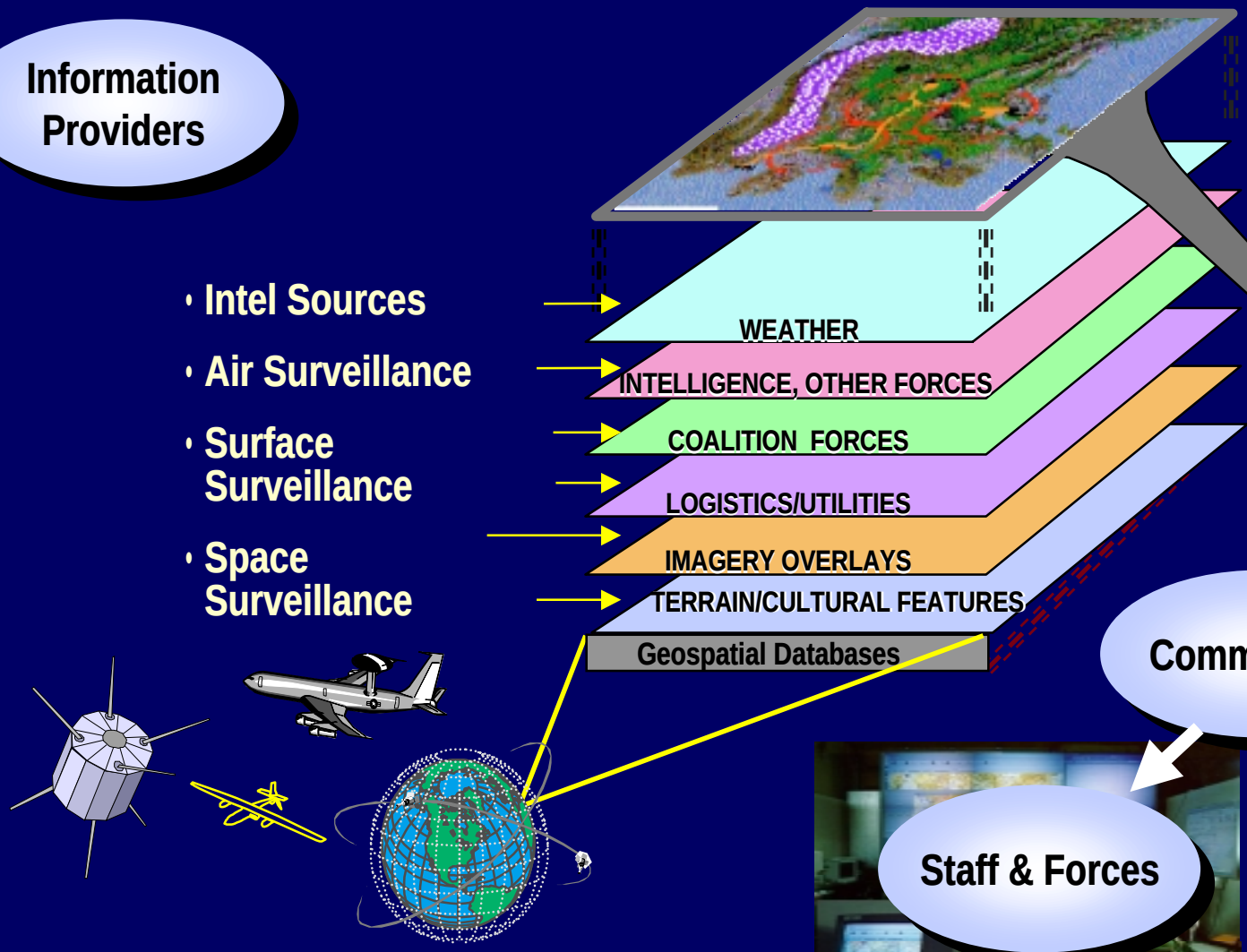
Collaborative planning and execution

Facilitate post crisis reshaping

Information Preparation of the Battlespace

Information Providers

- **Intel Sources**
- **Air Surveillance**
- **Surface Surveillance**
- **Space Surveillance**



Common Operational Picture

JBI

Commanders

!

Staff & Forces

Respond to Crisis by Activating the JBI

- Activate operational template
  - Enhance situational awareness
  - Exploit information operations
  - Robust Command and Control capabilities
  - Task forces as required
  - Synchronize logistics
  - Deploy and bed down forces

- JBI Enablers
  - Templates automate the tracking of data (publish and subscribe)
  - Automate the management of ISR tasking and dissemination
  - Fuselets refine and integrate data into useful information
  - Prioritized comm requirements to maximize reachback capabilities

Force Template

Information handshake between the JBI and the combat unit (defines subscribe and publish data to JBI).

Information interface requirements:

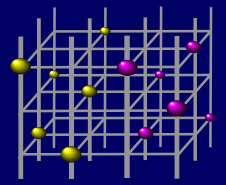
- Information required to accomplish mission
  - Example: Required accuracy of targeting information

C2 and ISR capabilities:

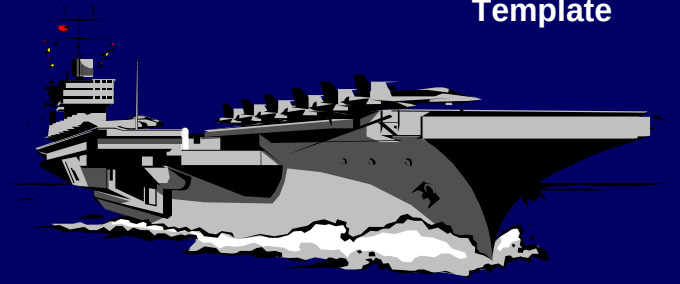
- ISR inputs to JBI
  - Example: weapons pod camera

Force capabilities:

- Sortie rates (steady state and surge)
- Employment restrictions
- Munitions (TLAMs)
- Current readiness state
- Logistics requirements



Force Template



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Building Decisive Combat Power

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Building Decisive Combat Power

- Employ for combat operations
  - Determine NCA guidance
  - Publish Commander's intent and desired effects
  - Determine centers of gravity
  - Develop and analyze COAs
  - Direct component detailed planning
  - Components develop scheme of maneuvers
  - Employ lethal and non-lethal weapons
  - Execute and assess effects
- Enabling JBI features
  - Automatic option generation and evaluation
  - Collaborative planning between echelons and across components
  - Continuous update from source to decision support and analysis tools

!

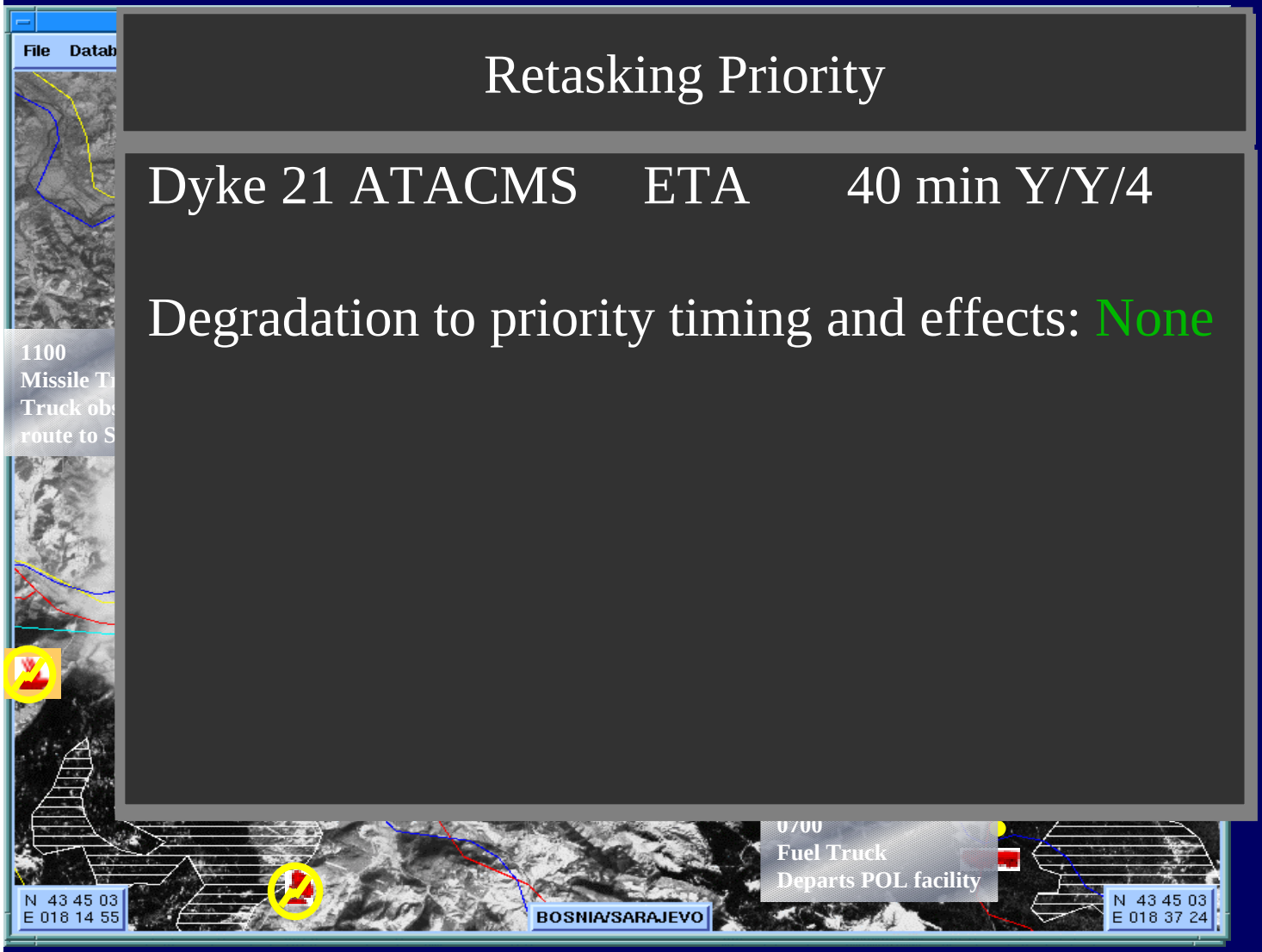
Tailoring to the User's Needs

- User modeling - Real-time understanding of user(s)' goals, plans, and preferences
- Context understanding - Real-time translation of user(s)' situation, tasks at hand, and device used

H-1

H-2

Dynamic Battle Management



Retasking Priority

Dyke 21 ATACMS ETA 40 min Y/Y/4

Degradation to priority timing and effects: None

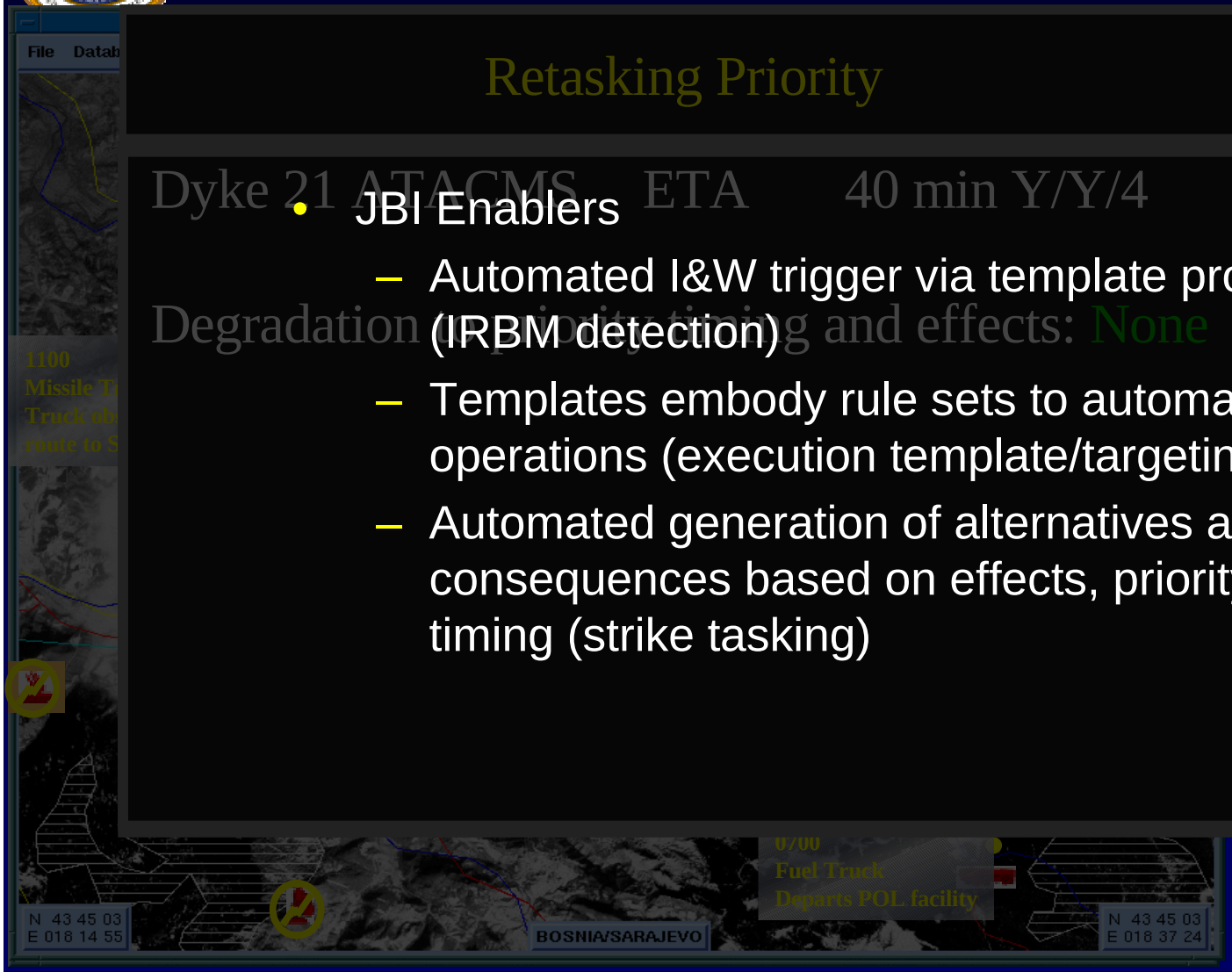
- Imagery
- Cultural Feature
- Real-time Sensor
- MTI Tracks
- SIGINT
- Air Tracks !
- Real-time Tasks

IRBM Detection

Targeting

Strike Tasking

Dynamic Battle Management



- JBI Enablers
  - Automated I&W trigger via template profiles (IRBM detection)
  - Templates embody rule sets to automate operations (execution template/targeting)
  - Automated generation of alternatives and consequences based on effects, priority and timing (strike tasking)

Imagery

Cultural Feature Overlay

Real-time Sensor Overlay

MTI Overlay

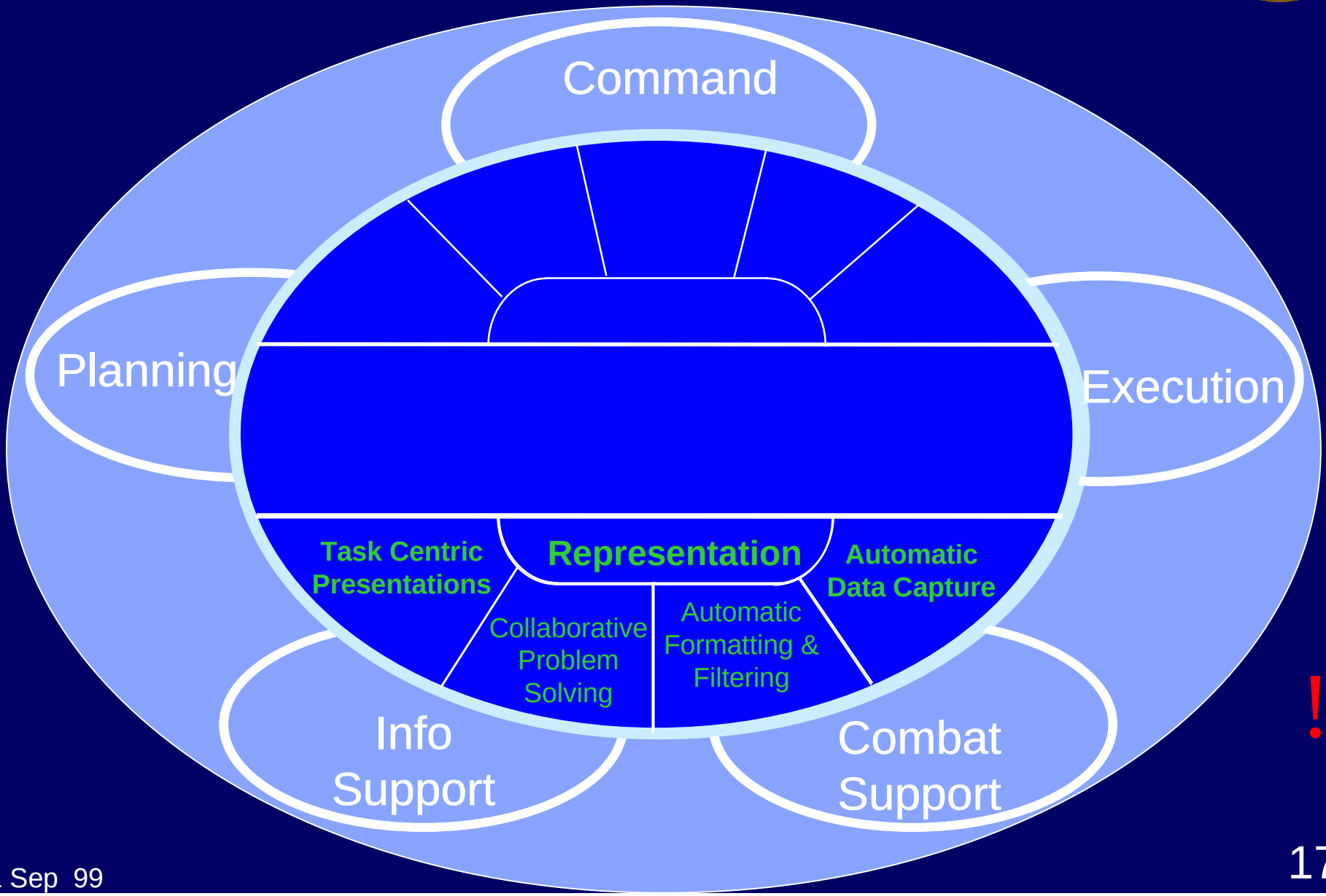
SIGINT Overlay

IRBM Detection

Targeting

Strike Tasking !

Interacting with the JBI



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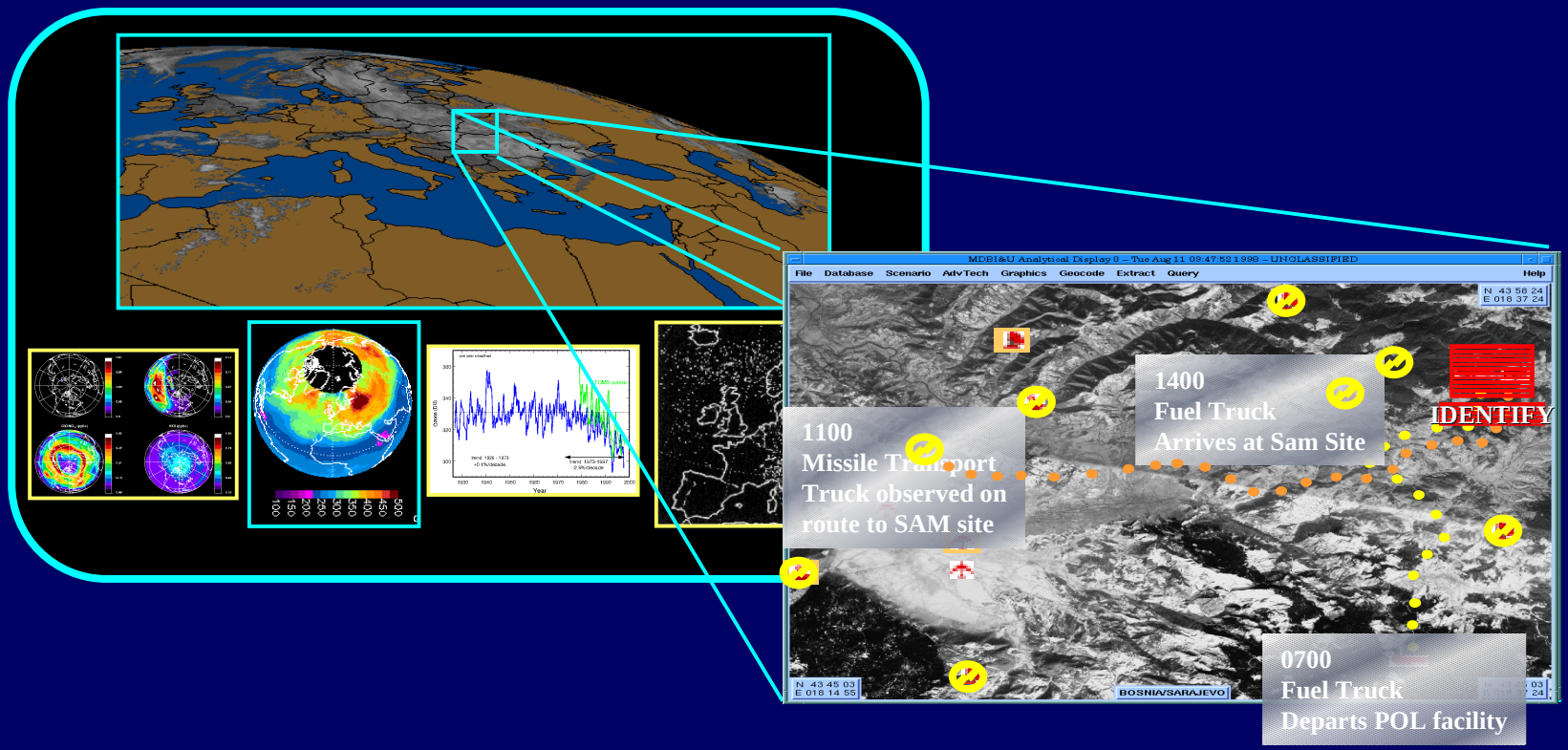
Task Centric Decision Making Command Example

JBI *transforms* alert to support Commander's task and preference.



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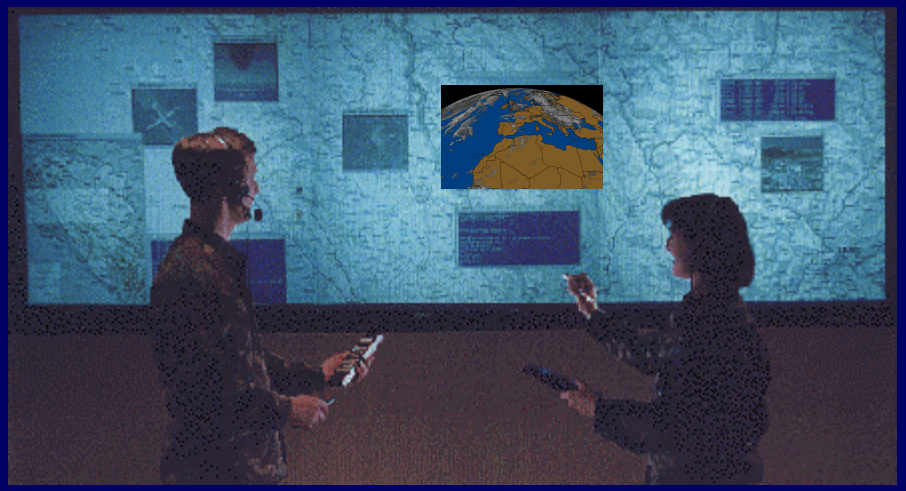
Collaborative Problem Solving Planning Example

Staff *subscribes* to collaborator assessments and *publishes* ATO execution.



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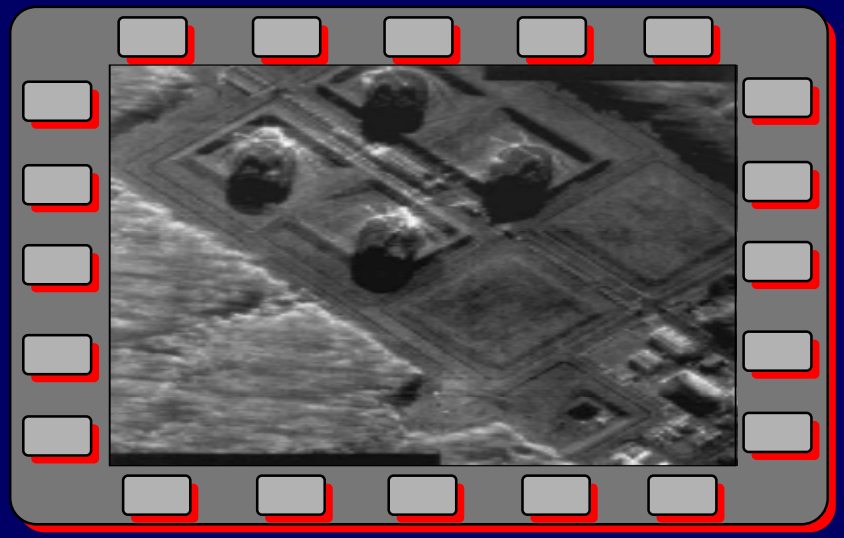
Automatic Formatting and Filtering Execution Example

Information is *transformed* for the cockpit.



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Automatic Data Capture Combat Support Example

F-18E scheduler *subscribes* to aircraft status and assigns sortie. F-18E launches.

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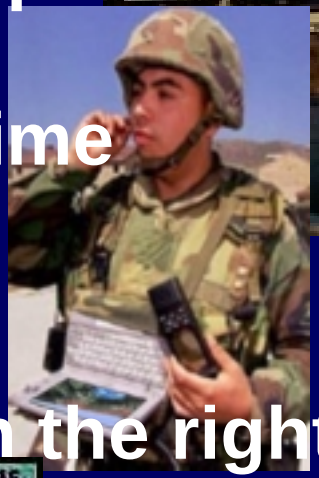
Interact Goal

Get the right information

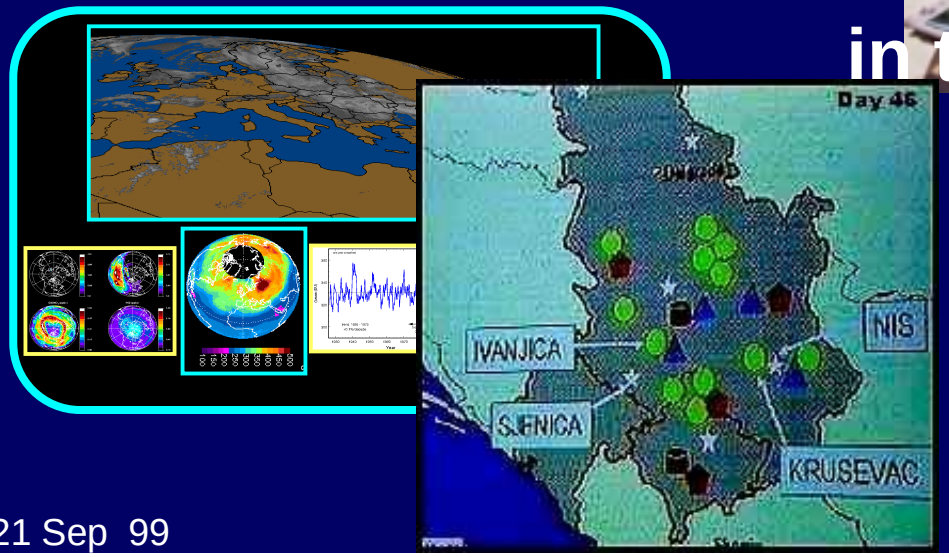
to the right people

at the right time

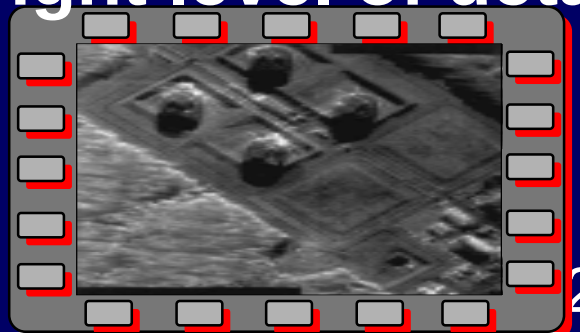
and the right media



in the right language



at the right level of detail



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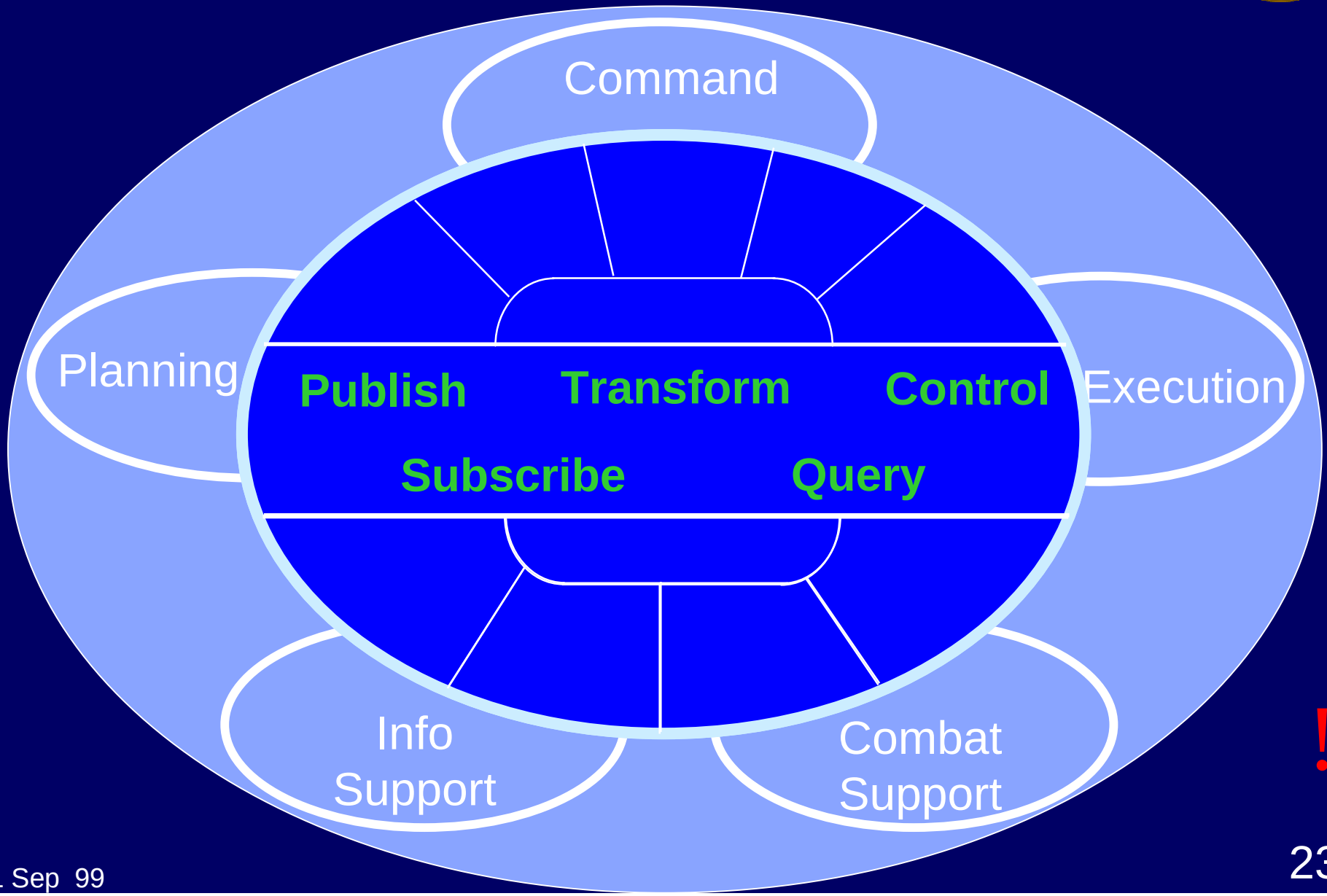
JBI Manipulate



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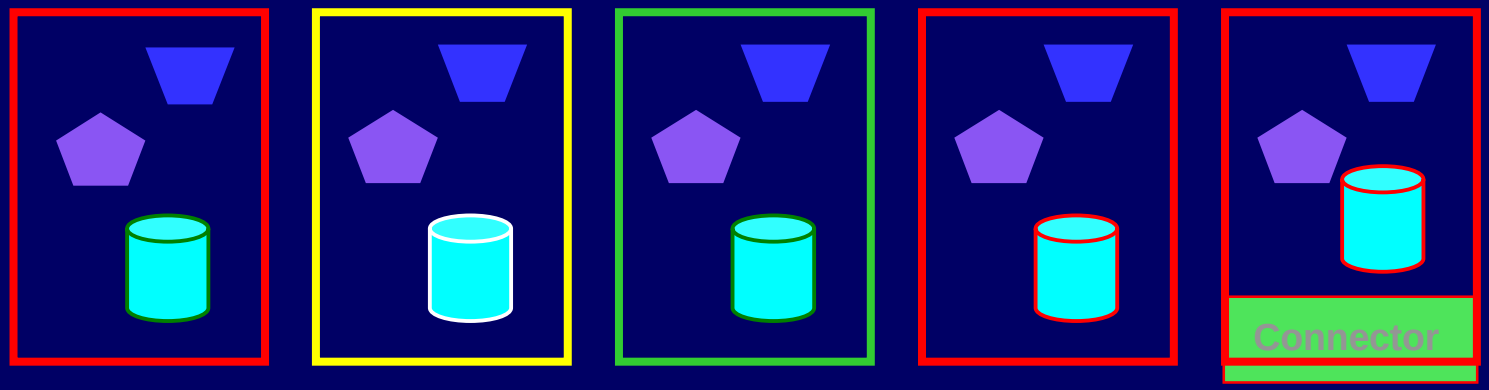
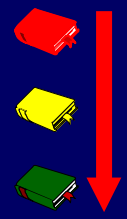
JBI Technical Architecture

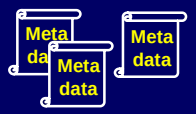


JBI Clients

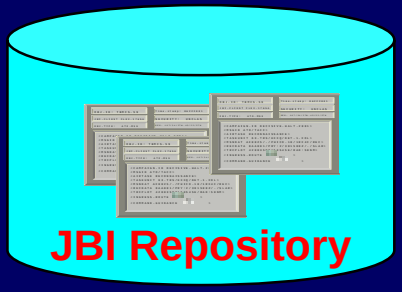
Global Grid, Web, Internet,….

Access Policy





JBI Query Broker



JBI Subscription Broker

JBI Management Services

ACCESS

JBI Platform

Objects and Metadata

METADATA

OBJECT

OBJ-ID: TBMCS-59	Time-stamp: 06222001
JBI-CLIENT FLEX-1765A	SECURITY: UNCLAS
OBJ-TYPE: ATO-MSG	GEO: 167/34/27W-45/22/57N

ATTRIBUTES AND VALUES

<CAMPAIGN-ID DECISIVE-HALT-2001>
<MSGID ATO/TACC>
<AIRTASK RECONNAISSANCE>
<TASKUNIT 63-TRS/KXXQ/DET-1-FOL>
<MSNDAT AF0025/-/PHICO-10/1RF4C/REC>
<RECDATA 8AA001/PRY:2/301500Z/-/SLAR>
<TRCPLOT 420035N0153545E/RAD:50NM>
<INGRESS-ROUTE >
<COMMAND-GUIDANCE >

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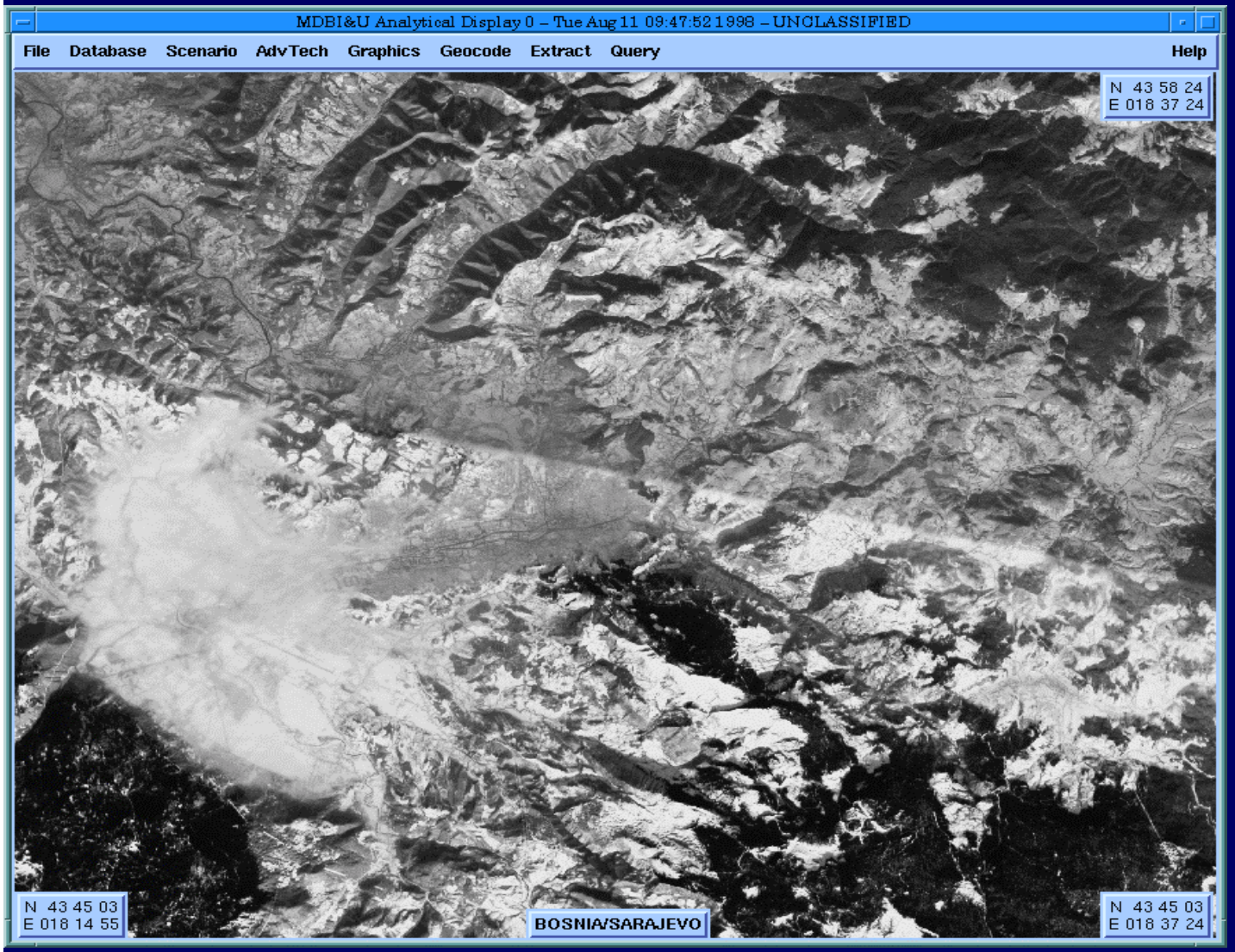
Input Overhead Imagery



Imagery

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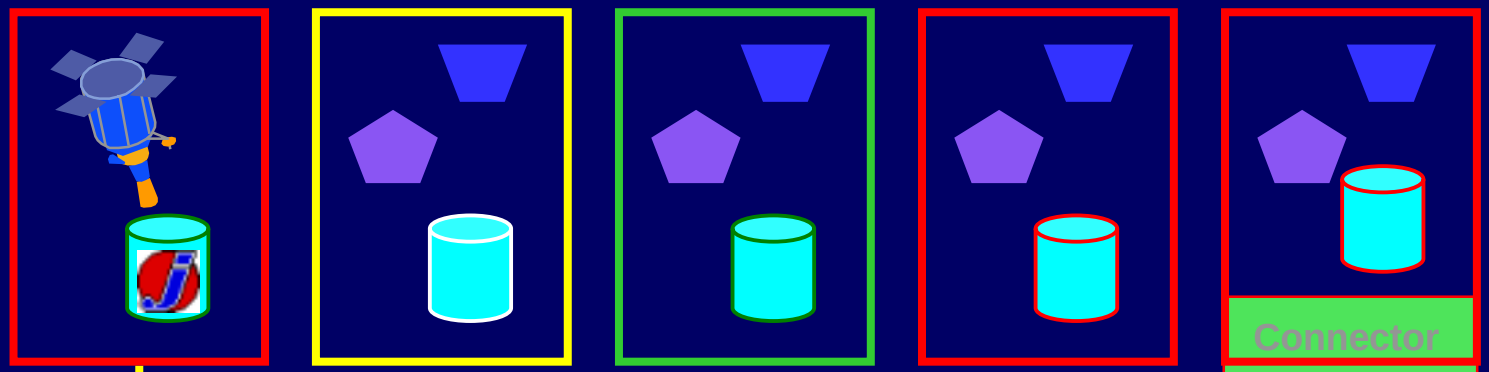
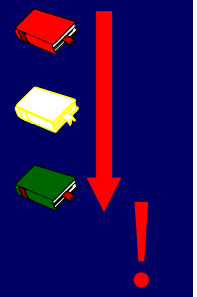
Publish Overhead Imagery

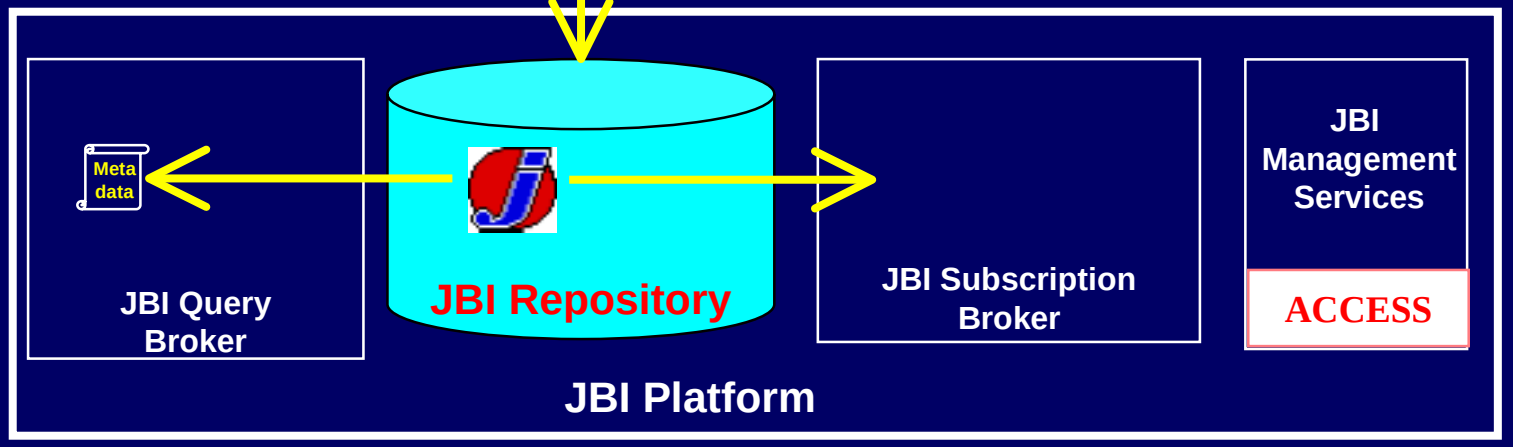


JBI Clients

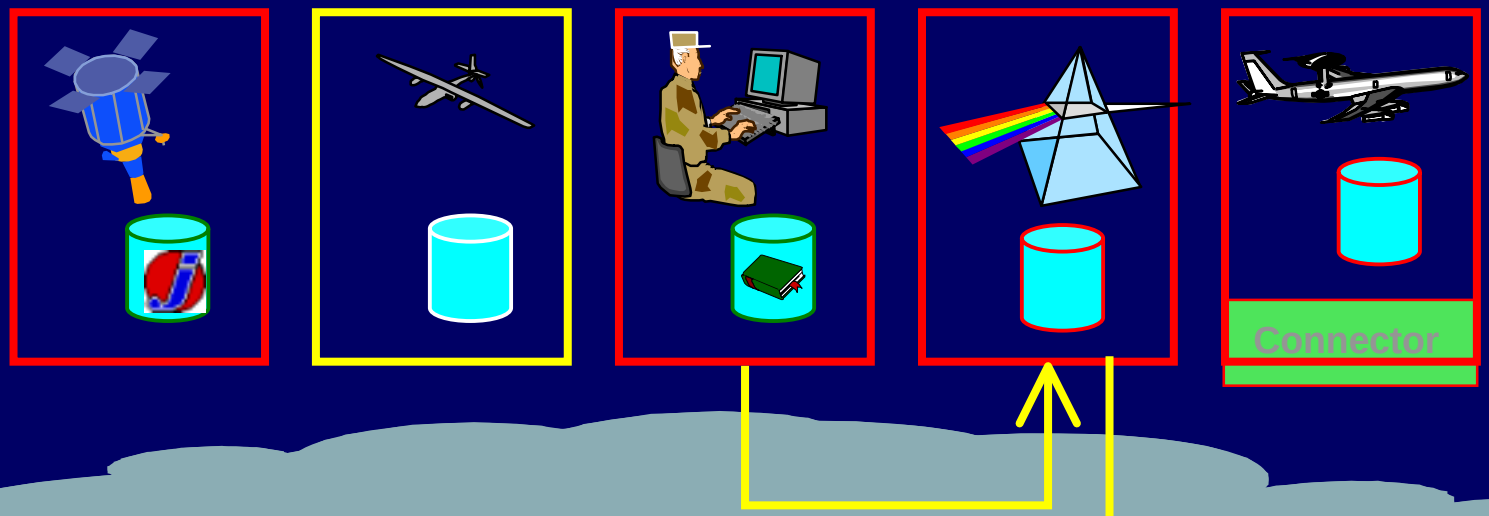
Global Grid, Web, Internet,….

Access Policy





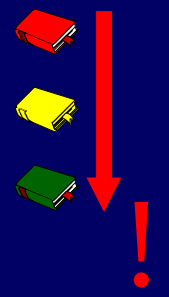
User Starts Fusion Engine

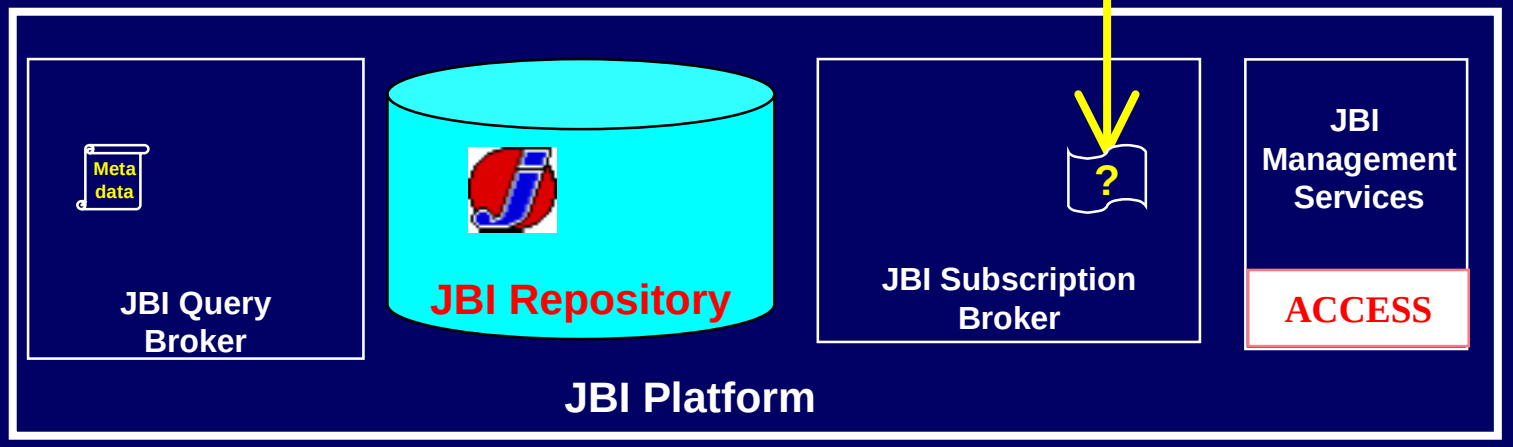


JBI Clients

Global Grid, Web, Internet,….

Access Policy



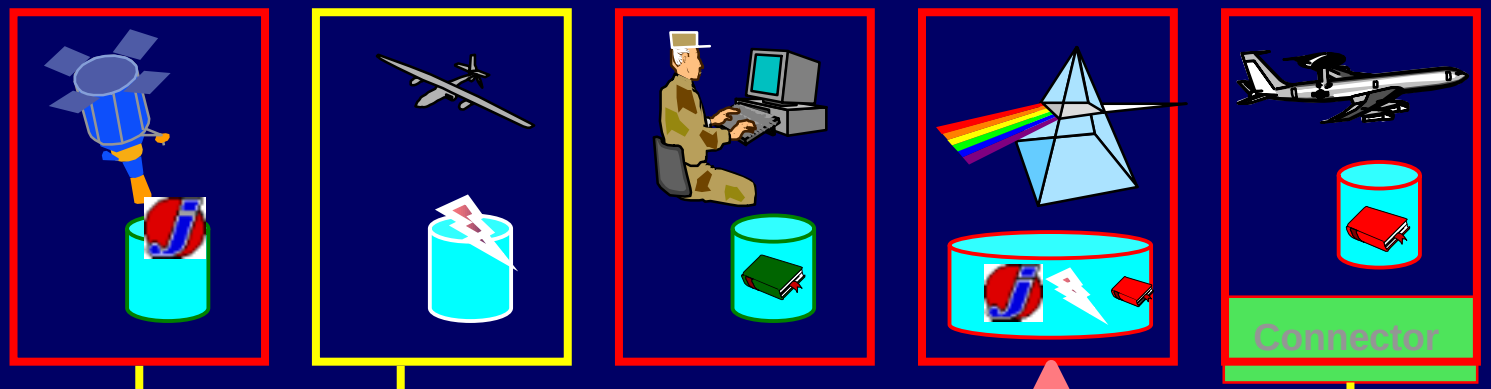


Input Additional Sources

- **Imagery**
- **Cultural Features**
- **Real-time Sensor Data**
- **MTI**
- **SIGINT**

!

Publish Additional Sources



JBI Clients

Global Grid, Web, Internet.....

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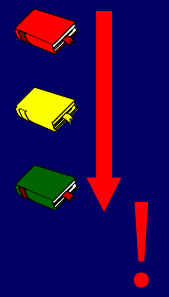
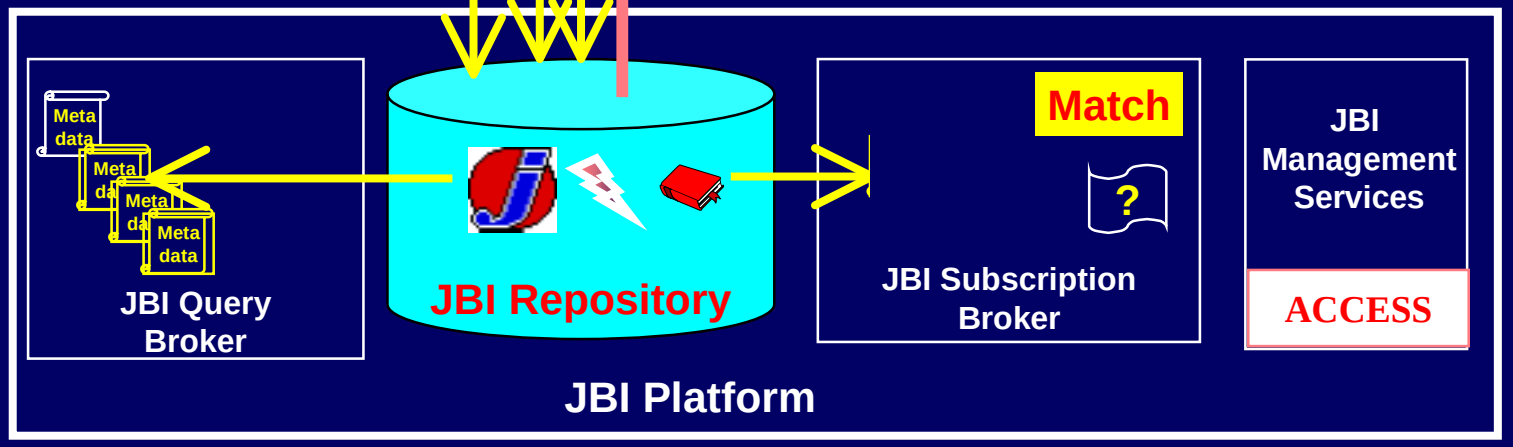




Fusion Engine Finds a Target

- Imagery
- Cultural Features
- Real-time Sensor Data
- MTI
- SIGINT
- Enhanced All Source Fusion

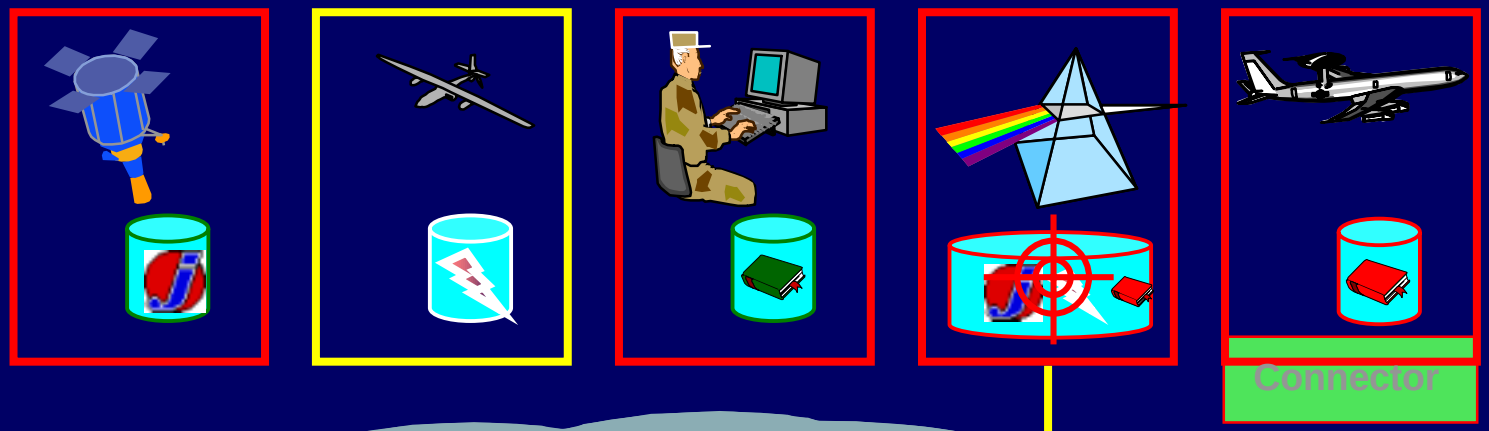
!

User Approves Target Nomination

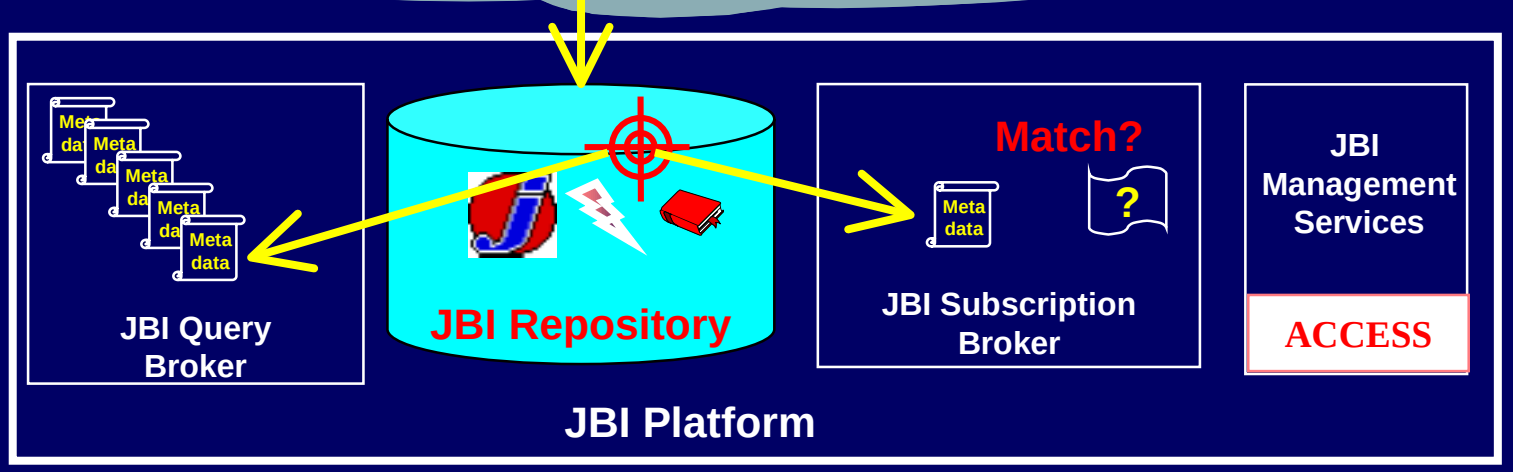
- Imagery
- Cultural Features
- Real-time Sensor Data
- MTI
- SIGINT
- Enhanced All Source Fusion

!

Publish Nominated Target



Global Grid, Web, Internet,….



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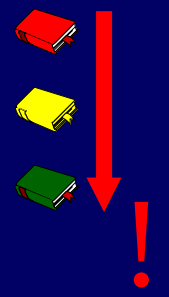
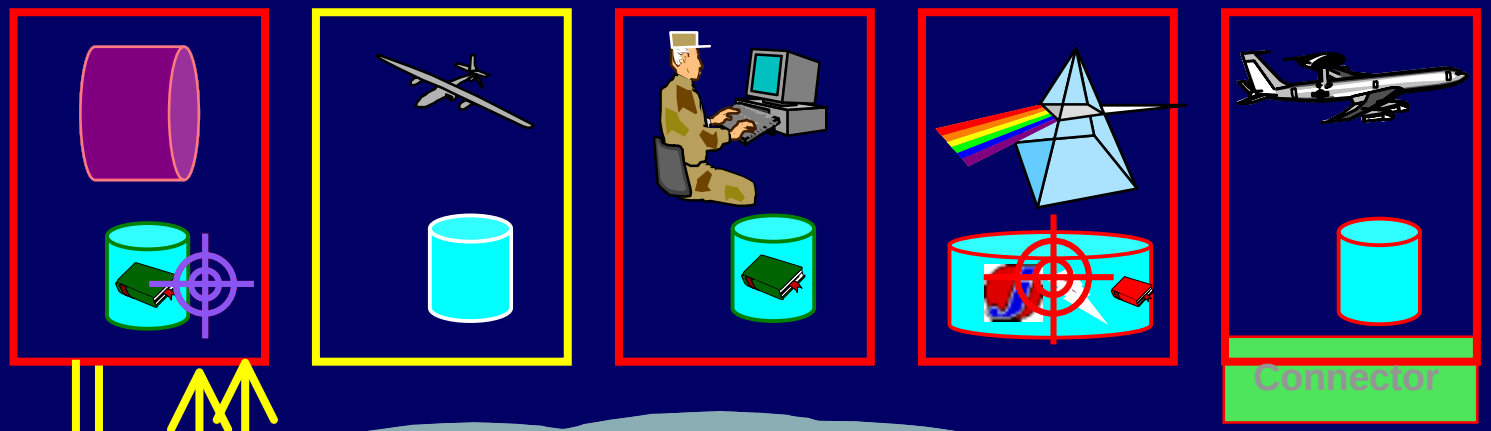


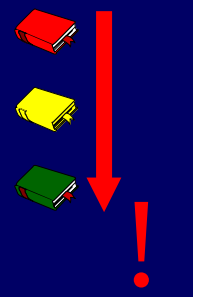
Fuselet Assigns Target Priority

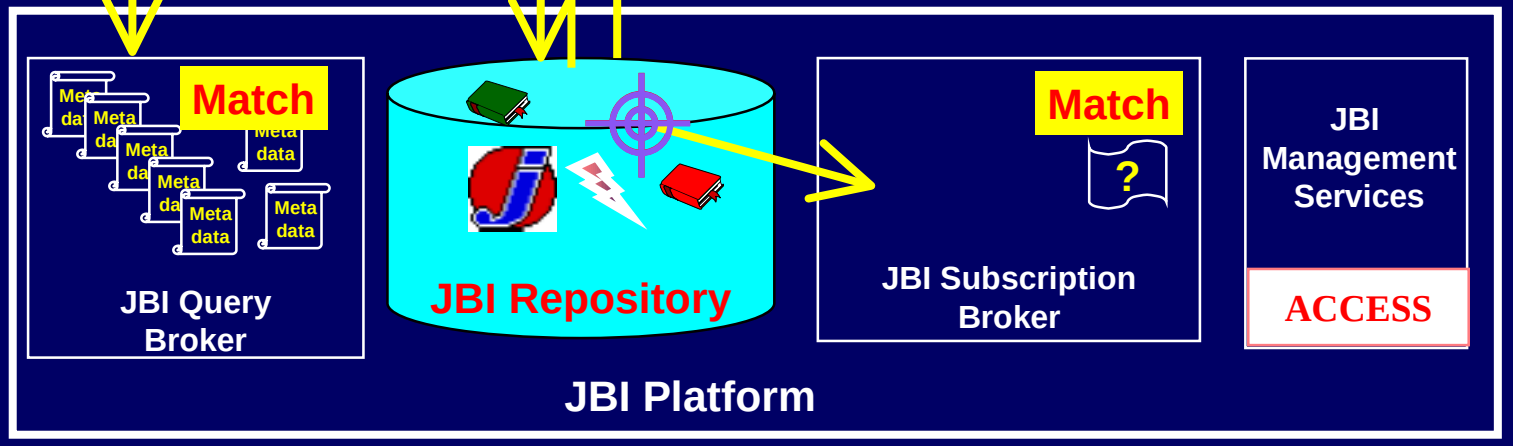


JBI Clients

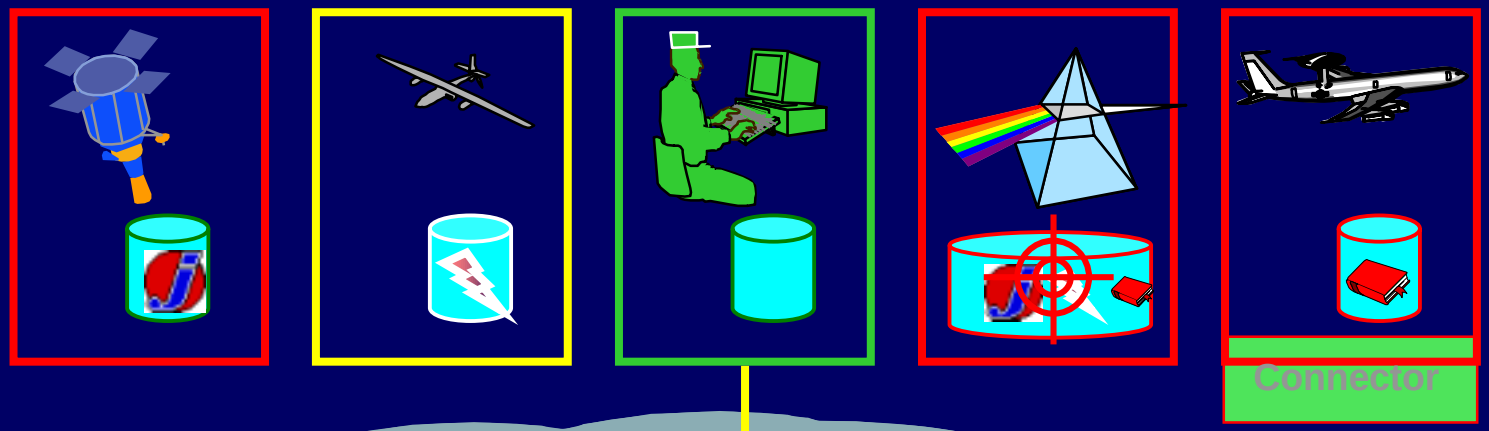
Global Grid, Web, Internet,….

Access Policy

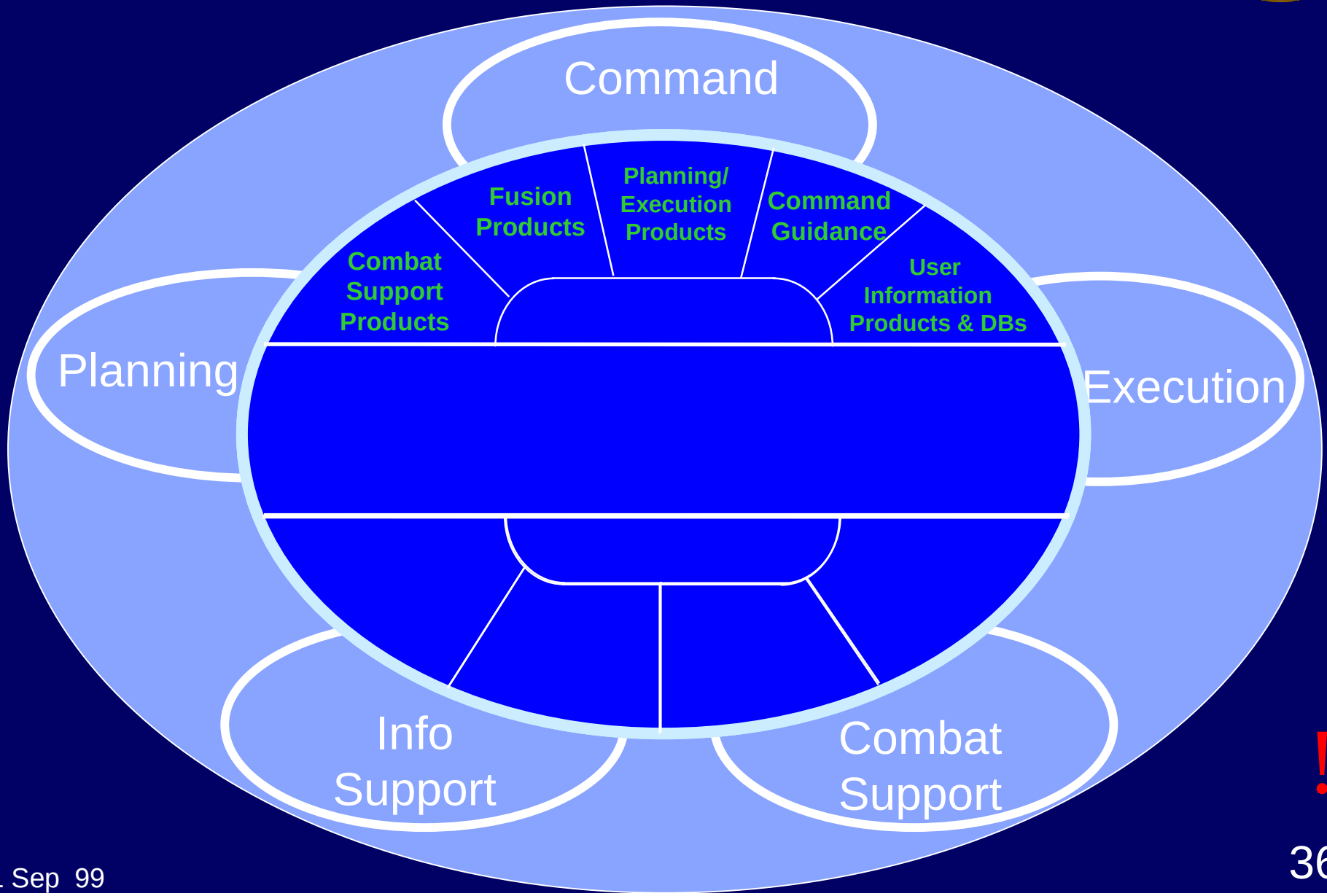




Unauthorized User Queries Target List



JBI Input

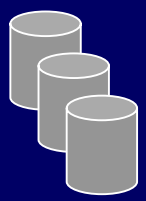

Command
Fusion Products
Planning/ Execution Products
Command Guidance
Combat Support Products
User Information Products & DBs
Planning
Execution
Info Support
Combat Support

!

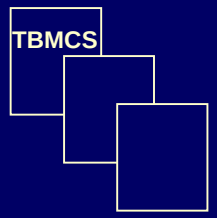
JBI Inputs

Legacy Data Bases

- Logistics
- Intel
- Personnel
- Weather
- Operations



Existing Applications



External Sensors

- Direct Sensor Feeds (Processing & Exploitation)
- Finished Products (Inputs to Decision Making)

Web-based Sources

Unclassified - Internet

+

Classified - Intelink

- Wrappers
- Mediators
- Agents

Tasking for New Collection

Finding Relevant Info (Push & Pull)

JBI

Information Acquisition

Fusion & Monitoring

Battle Management Input Functions

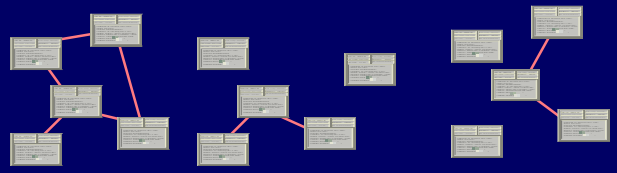
Fusion Products | **Planning/ Execution Products** | **Combat Support Products** | **Command Guidance** | **User Information Products& DBs**

Translation & Wrapping | **Semantic Integration** | **Information Assurance**

Information Acquisition

All-Source Fusion | **Event Monitoring** | **Collection Management**

Fusion & Monitoring



JBI Object Repository

JBI Agent-based Pull

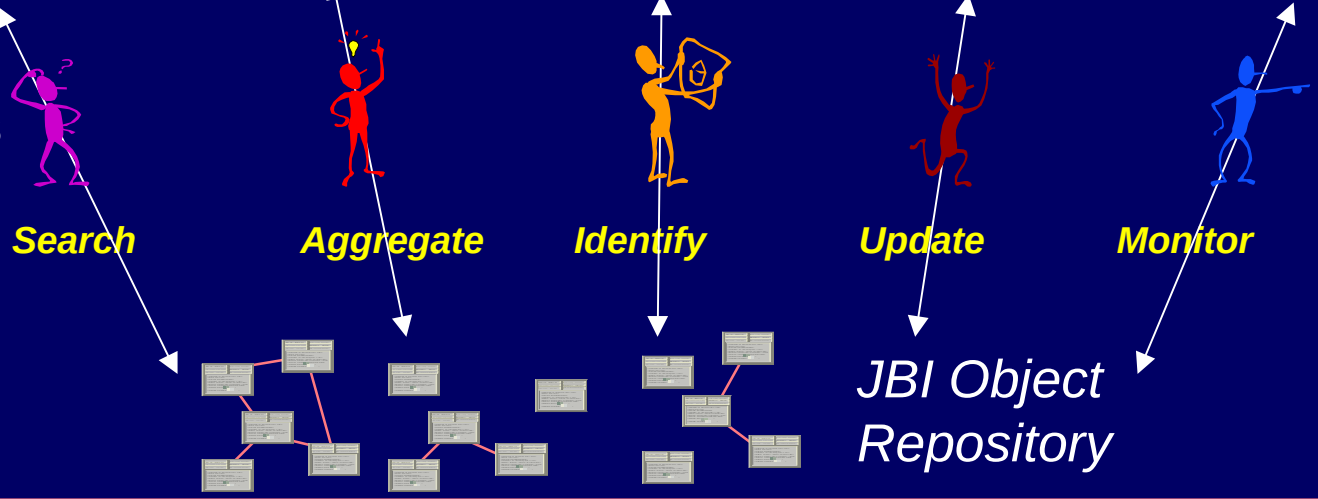
EXISTING LEGACY & EVOLVING SYSTEMS

- TBMCS
- JPN COP
- CGS MTI
- JTN Tracks
- Other Systems and Assets

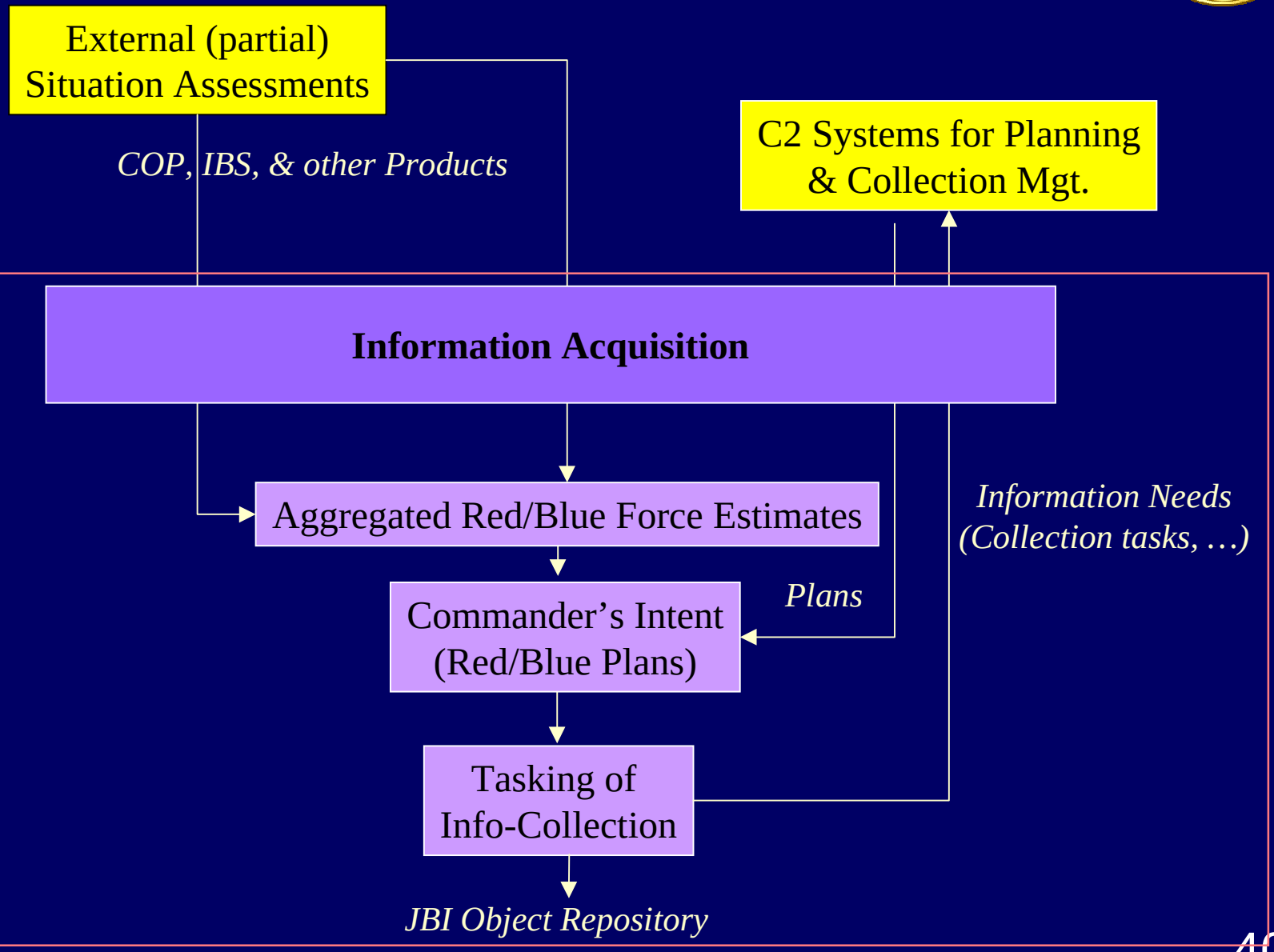
Information Acquisition

Source Info | Data Formats | Capability Specs | Input Specs | Status Info

FUSELETS



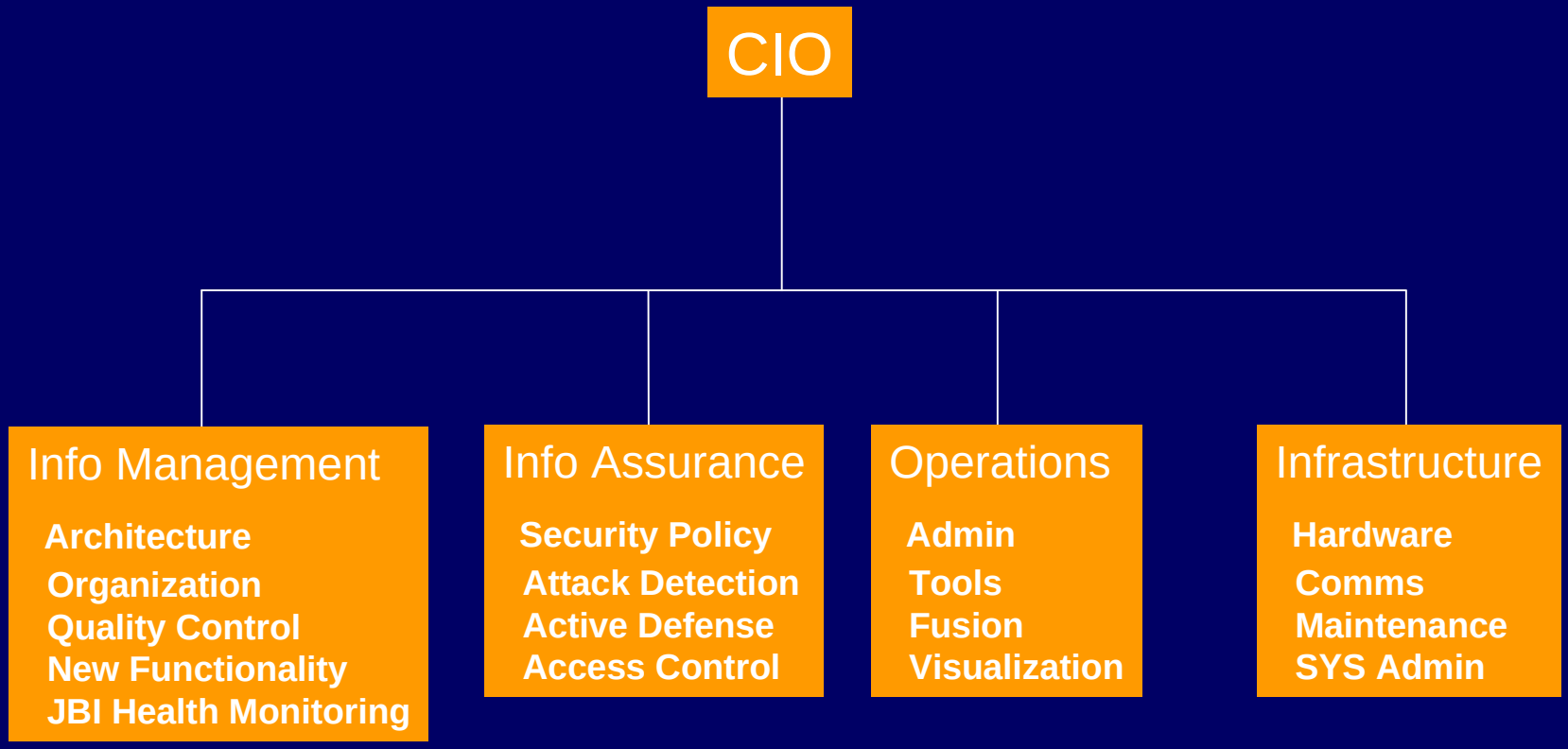
JBI Fusion Functionality



Information Staff

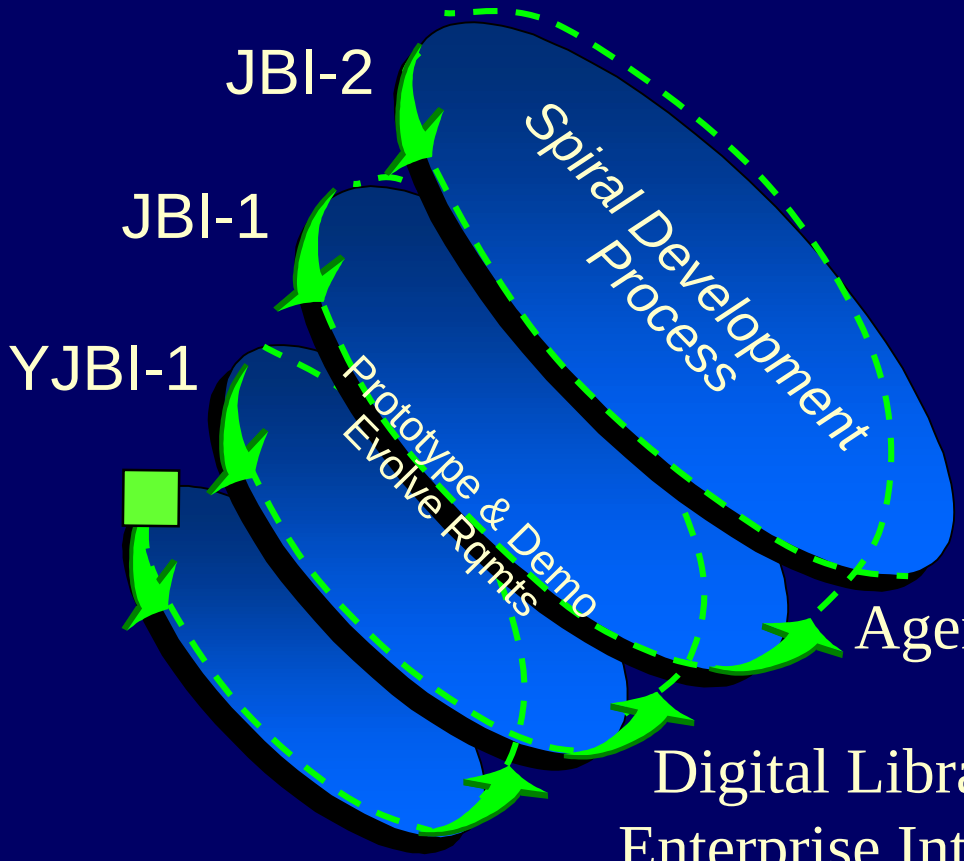
- People who can exploit information for warfighting advantage: need to understand information technology and military missions and business processes
- Organize with skills and authority similar to commercial IT operations staff
- “Own and operate” JBI Platform services
- Understand & adapt JBI information architecture
- Operate JBI as mission evolves: add operational units, connect to coalition partners, integrate with new information sources, enforce access policies

Information Staff Organization



Staffed by functional expertise from Ops, Intel, Logistics, Comm, etc.

Leveraging Commercial Technology



Agent Technology

Digital Libraries & Enterprise Integration Technology

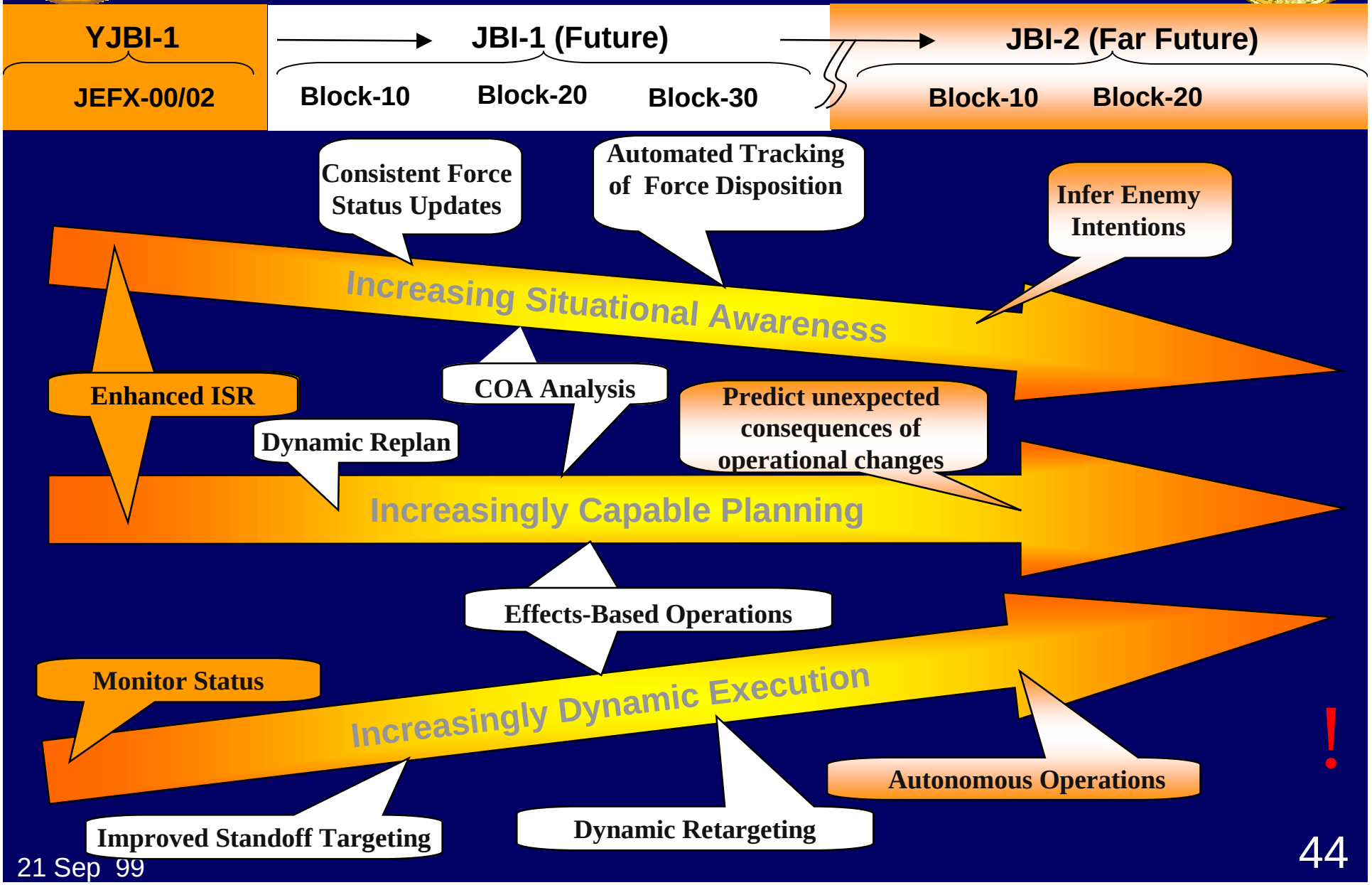
Web Technology

!

Commercial Availability

Today → Near-Term → Long-Term

Capability Roadmap



Build It and They Will Come

- Build rapid prototypes *now* (YJBI-1)
  - low cost concept evaluators, possible JEFX00 participation
  - web browser interaction, XML with common representation, COTS middleware
- Begin spiral development (leading to JBI-1)
  - YJBI-1 prototypes used to initiate spiral
  - cross-disciplinary team with tri-service participation
  - supported by JBI architecture analysis
  - supported by concurrent standardization efforts to define tri-service common representations
  - supported by long-term research efforts to evolve components

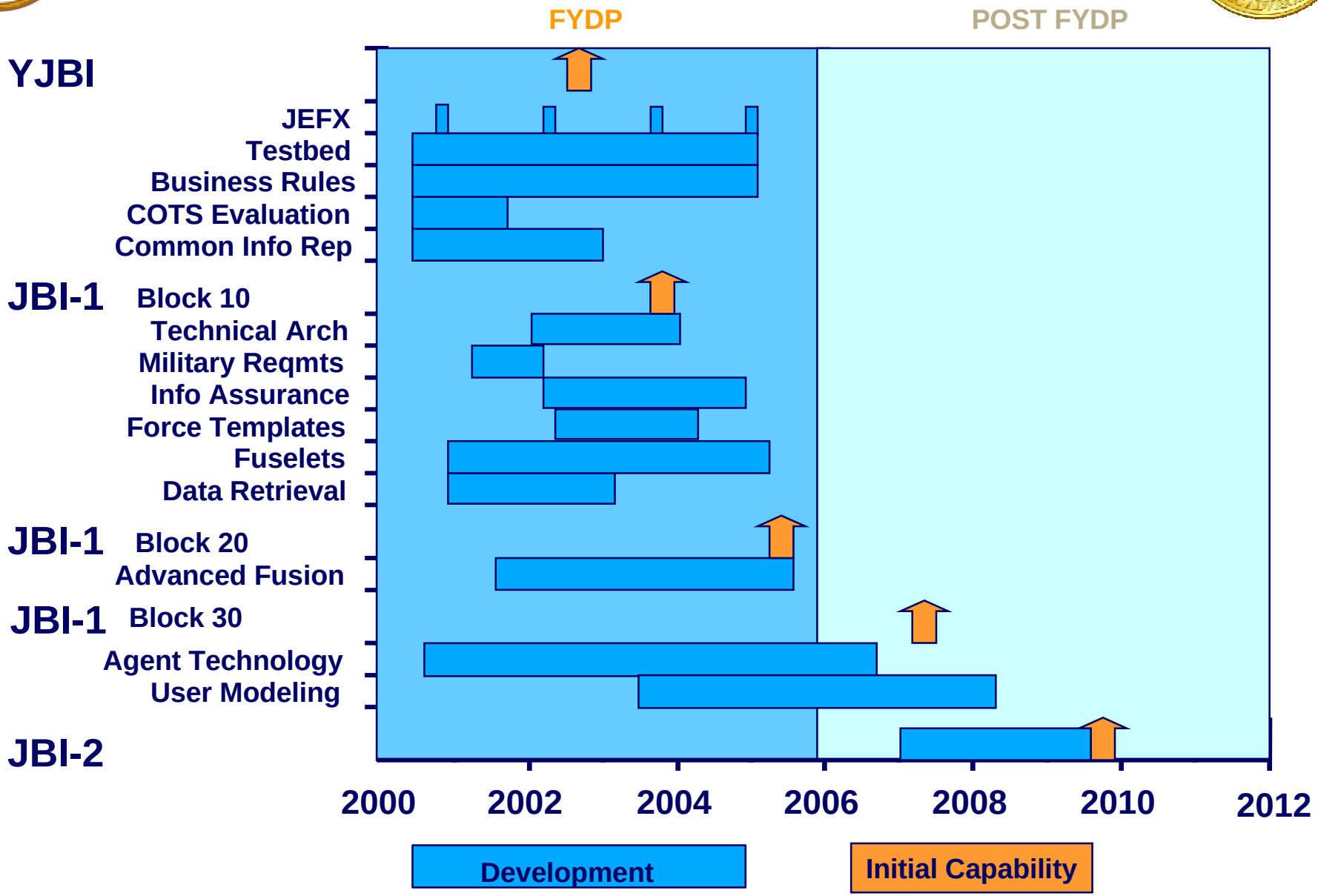
Specific Recommendations

- AF should make organizational preparations for JBI-1
  - Team AC2ISRC and ESC to develop an integrated C2 capability with the JBI
  - Air staff should create information staff function
- Evolve operational concepts to use JBI
  - Collaborative joint information integration
  - Automatic data capture
- Common representation for force unit templates

Specific Recommendations

- Immediate low-cost prototypes: AFRL/AC2ISRC
- JBI Platform technical architecture: ESC
- Evaluation of relevant COTS: ESC
- Military requirements for C2 Info Integration: AC2ISRC
- Common Representation/Templates: DISA/ESC
- Long term research:
  - Advanced JBI Platform: DARPA with AFRL
  - Advanced fusion concepts: AFRL with DARPA
  - Information assurance: DARPA with AFRL
  - Agent-based technology: DARPA with AFRL
  - Advanced data survivable systems: DARPA/AFRL
  - Active networks: AFRL
  - Dynamic User Modeling: DARPA/AFRL

JBI Roadmap


FYDP
POST FYDP
YJBI
JEFX
Testbed
Business Rules
COTS Evaluation
Common Info Rep
JBI-1 Block 10
Technical Arch
Military Reqmts
Info Assurance
Force Templates
Fuselets
Data Retrieval
JBI-1 Block 20
Advanced Fusion
JBI-1 Block 30
Agent Technology
User Modeling
JBI-2
2000
2002
2004
2006
2008
2010
2012
Development
Initial Capability

Actionable Recommendations

- Commit to acquire the JBI as a major weapons system
- Create an Information Staff function
- Develop new concepts of operations at AC2ISRC
- Define common information representations led by ASD-C3I
- Reinforce DARPA R&D investment for JBI technologies
- Focus AFRL, other Service research labs, and battlelabs on evaluating and applying commercial technologies for JBI
- Create the JBI testbed *now* for JEFX 00 participation
- Link JBI testbed to other service efforts in digitized battlefield and network-centric warfare
- Evangelize JBI to the CINCs

United States Air Force
Scientific Advisory Board

Building the Joint Battlespace Infosphere

1999 Study

Recommendations Relating JBI to Operations Other Than Conventional War Study Recommendations

- Implement a force management capability for the EAF and for OOTCW
- Lead the development and deployment of an integrated ISR - C2 Information Management System
- Implement AEF communications for rapidly emerging crises
- Create a Distributed Mission Readiness System from the Distributed MissionTraining Concept
- The Air Force should integrate planning and execution systems for employment and sustainment

- All JBI recommendations support these OOTCW study recommendations

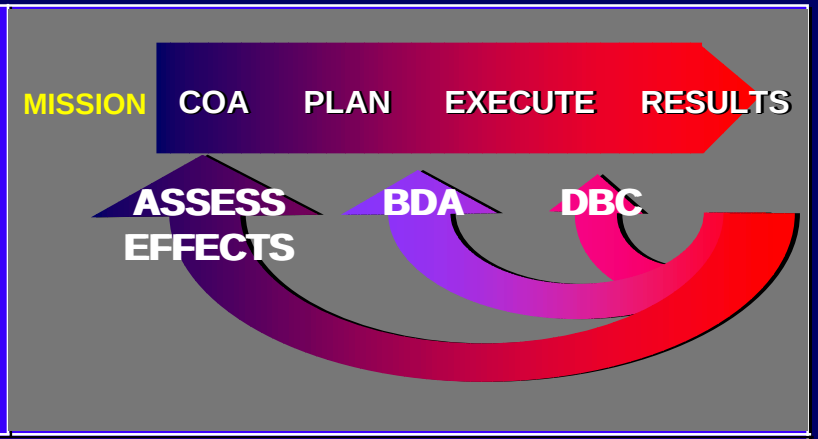
Implement a force management capability for the EAF and for OOTCW

FM/FD&S

Link to BI Study

Military Capability:

A force management system that supports the EAF in the application of aerospace power to OOTCW and enables dynamic effects-based planning, execution, and effects assessment to include strike, airlift, and training. Feedback consists of Dynamic Battle Control (DBC), Action or BDA, and effects assessment.



Capability Initiative:

Continue selective deployment of Theater Battle Management Core System (TBMCS), but:

- Immediately begin preparation of an operational architecture to assure TBMCS meets the needs of the EAF in OOTCW. Include logistics, training and lift aspects. (AC2ISRC)
- Assess the proper future course of action for TBMCS based on this architecture. (AF/XO, SAF/AQ)
- Establish a new function equivalent to AF/XOR for architectures and CONOPS for integrated force management systems. (AF/XO)
- Develop C2ISR education within the Air Force and establish appropriate specialty codes. (AF/DP)

Lead the development and deployment of an integrated ISR - C2 Information Management System

I&V

Link to BI Study

Military Capability:

Meet stringent timelines for tailorable and continuously updated information on demand for warfighters worldwide. Dynamic ISR response to rapidly and significantly changing situations.

Technology / Implementation:

Develop operational architecture, functional requirements, and implementation roadmap. (AC2ISRC)

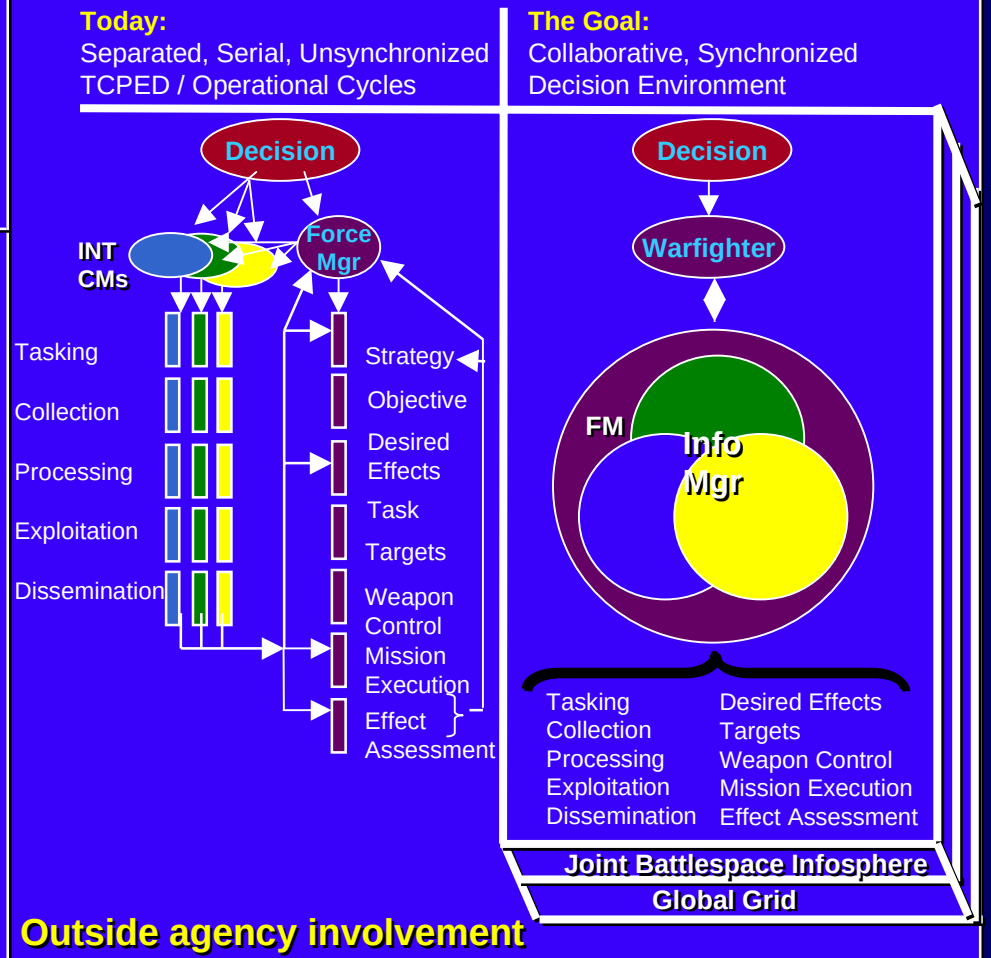
Pursue AF-owned elements of the roadmap. (SAF/AQ)

Lead joint DoD-Intel Community initiative for development and deployment. (AF)

- **JBI & Global Grid provide foundation**

Use demo to drive development of relevant technologies: (SAF/AQ)

- **Representation of Information**
- **Information Fusion**
- **Dynamic Allocation of Sensing Assets**
- **Interaction with the User**
- **Performance Assessment**



Implement AEF communications for rapidly emerging crises

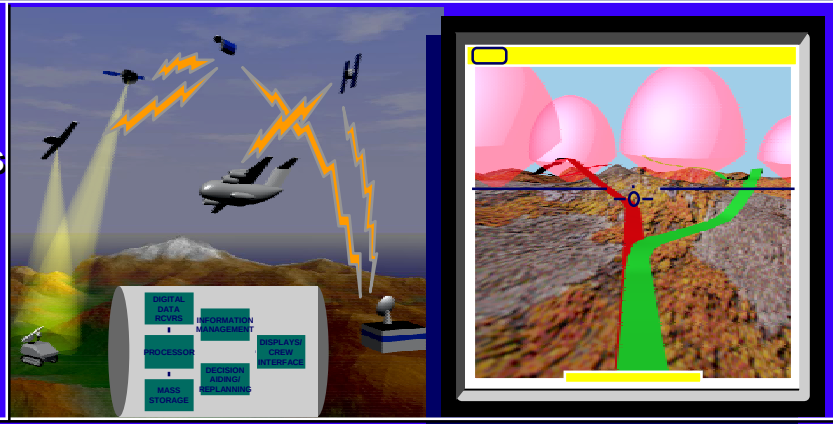
FM

Link to BI Study

Military Capability:

EAF communications enabling:

- **Immediate combat power for OOTCW crisis response anywhere**
- **Global Grid access**
- **Communications to support JBI**
- **Direct links to operational platforms**



Technology Initiatives/Enablers:

Multi-level secure communications architecture and requirements for OOTCW are the same as for MTW with the added features of *rapid reconfigurability, scalability, and deployability.* AEF HW/SW/BW environment should be the same as home station so that we "fight like we train." (AF/SC)

- **Develop and implement coalition interoperability for Joint/ Combined/ Civil EAF operations**
- **Implement a user requirements driven acquisition process with an emphasis on the controller/shooter**

Create a Distributed Mission Readiness System from the Distributed Mission Training Concept

ETE

Link to BI Study

Military Capability:

A robust and flexible AF-wide Distributed Mission Readiness System (DMRS) which integrates all force elements to help train and rehearse AEF personnel for full spectrum global engagement (MTW and OOTCW).

Combat **Logistics**

Force Protection

C4ISR

Airlift

Initiatives:

Establish overall AF leadership for DMRS. (AF/XO)

Implement Capstone Requirements Document for DMT and grow it into AF DMRS

- **AF-wide plans, architecture and roadmap (AF/XP, AF/XO)**
- **Formal acquisition strategy and force management plan (SAF/AQ)**
- **DMRS SPO to manage transition and integration (SAF/AQ)**

Maintain priority of current DMT efforts to bridge to DMRS (SAF/AQ, AF/XO)

Address major DMRS technical issues (SAF/AQ)

- **Multi-level security/need-to-know, latency issues, behavioral models**
- **Leverage related efforts in other services, ACOM, DARPA and outside agencies**

The Air Force should integrate planning and execution systems for employment and sustainment

D&S

Link to BI Study

Military Capability:

An optimized, effects based operational plan which incorporates deployment and sustainment feasibility and reduces deployment footprint

Technology Initiatives

- Develop automated selection of forces to achieve desired effect (AF/XO)
- Optimize deployment flow to achieve incremental, effects-based capability (OPR: AF/IL)

Capability Initiatives

- Develop an integrated operational architecture for employment planning (OPR: AF/XO)
- Develop automated force beddown tool based upon operational and employment characteristics of selected forces (OPR: AF/XO)
- Provide worldwide visibility of available sources of support (OPR: AF/IL)
- Automate deployment tailoring based on allocation of support resources (OPR: AF/IL)